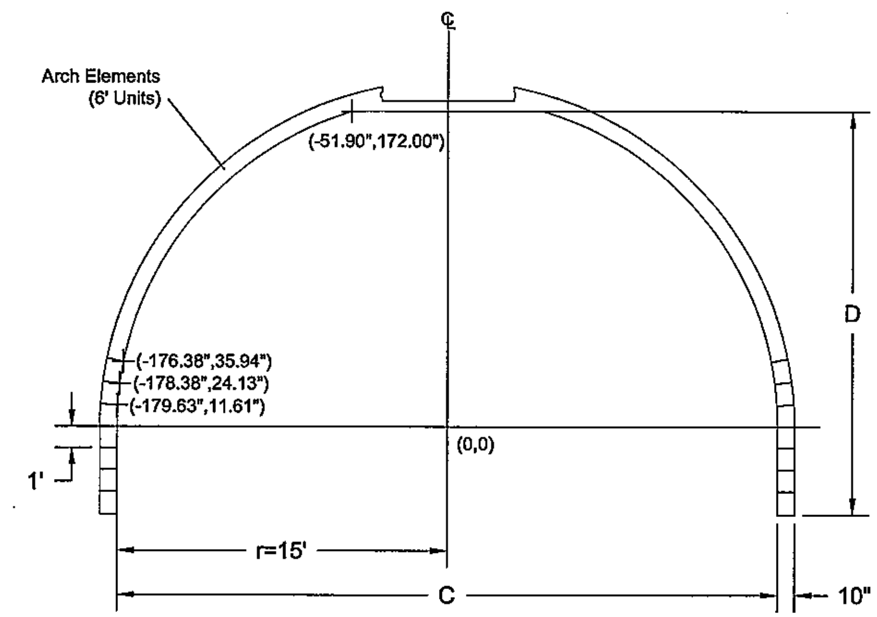
KYTC Approved List for 3-Sided Culverts
December 4, 2007

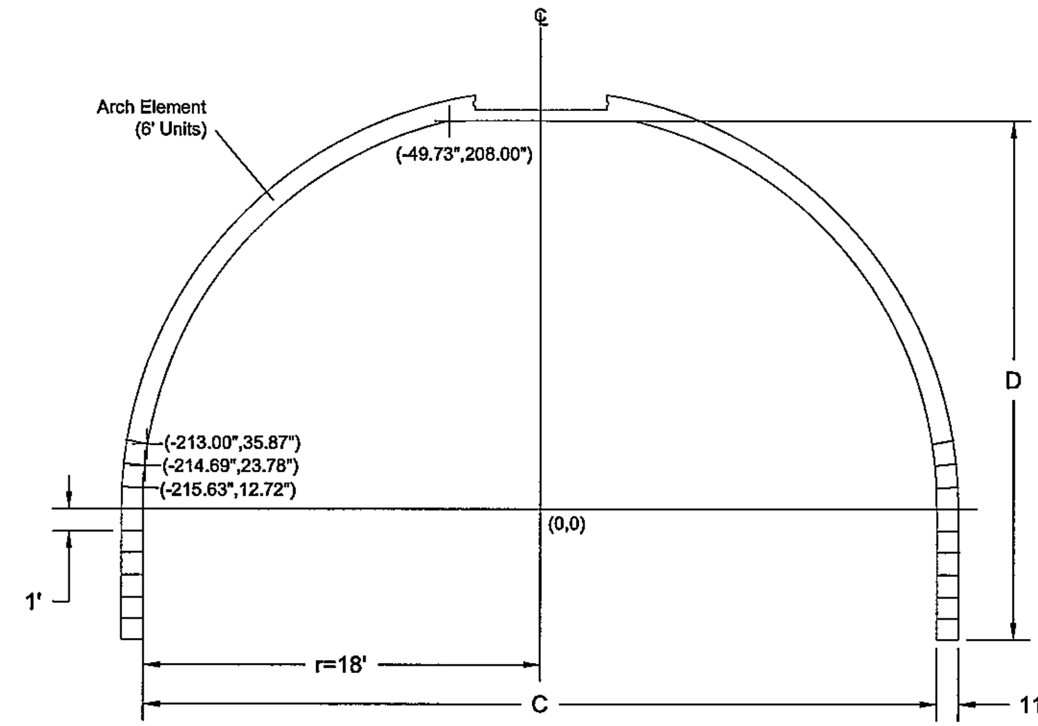
Table of Contents

Minimum Cover = 1.5'
Maximum Cover = 15' *

*Note: Special designs are available if additional cover is required.



C30T		
Span, C	Rise, D	Waterway Area (Sq. Ft)
29'-4 3/4"	11'-4"	260.0
29'-8 3/4"	12'-4"	289.6
29'-11 1/4"	13'-4"	319.4
30'-0"	14'-4"	349.4
30'-0"	15'-4"	379.4
30'-0"	16'-4"	409.4
30'-0"	17'-4"	439.4
30'-0"	18'-4"	469.4



C36T		
Span, C	Rise, D	Waterway Area (Sq. Ft)
35'-6"	14'-4"	397.1
35'-9 3/8"	15'-4"	432.8
35'-11 1/4"	16'-4"	468.6
36'-0"	17'-4"	504.6
36'-0"	18'-4"	540.6
36'-0"	19'-4"	576.6
36'-0"	20'-4"	612.6
36'-0"	21'-4"	648.1
36'-0"	22'-4"	684.6
36'-0"	23'-4"	720.6

Circle Centered @ (0,0)
$x^2 + y^2 = r^2$

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STANDARD DRAWINGS

KY TRANSPORTATION CABINET

BEBO C-SERIES GEOMETRY

JOB NO:

Minimum Cover = 1.5'
Maximum Cover = 15' *

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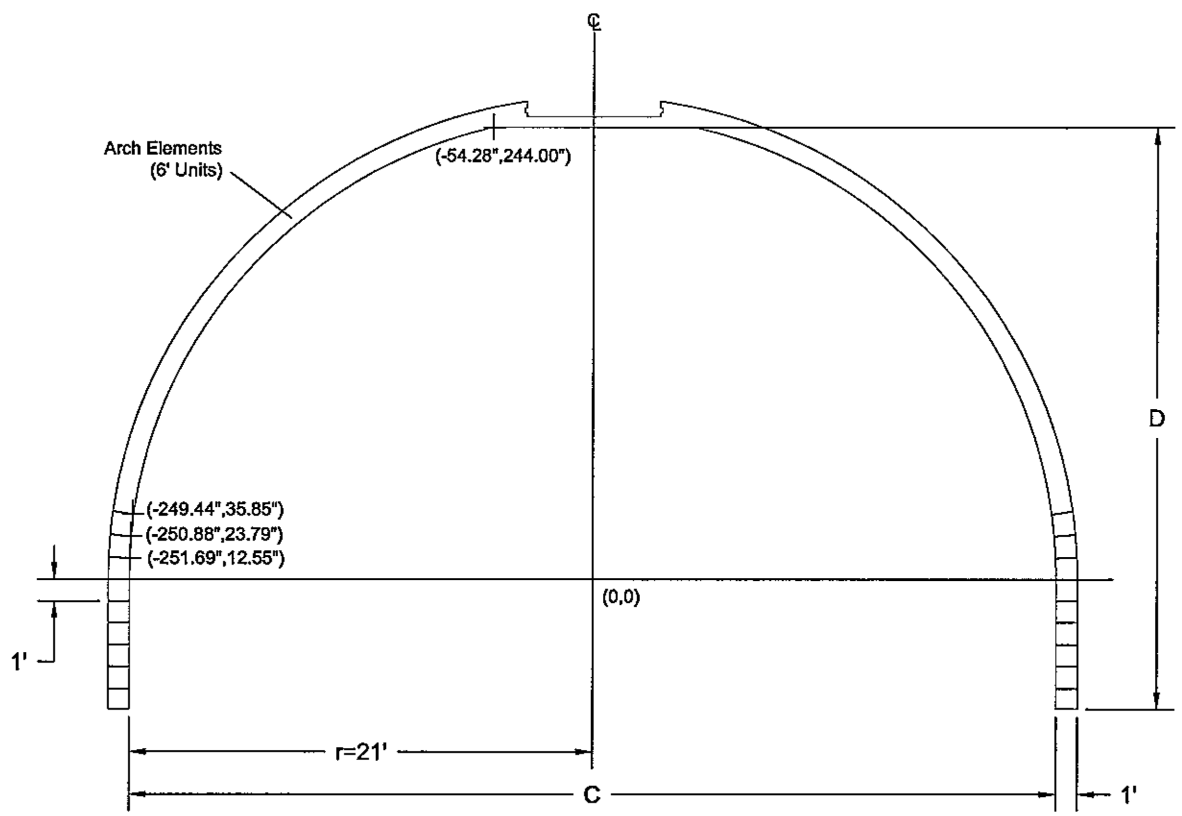

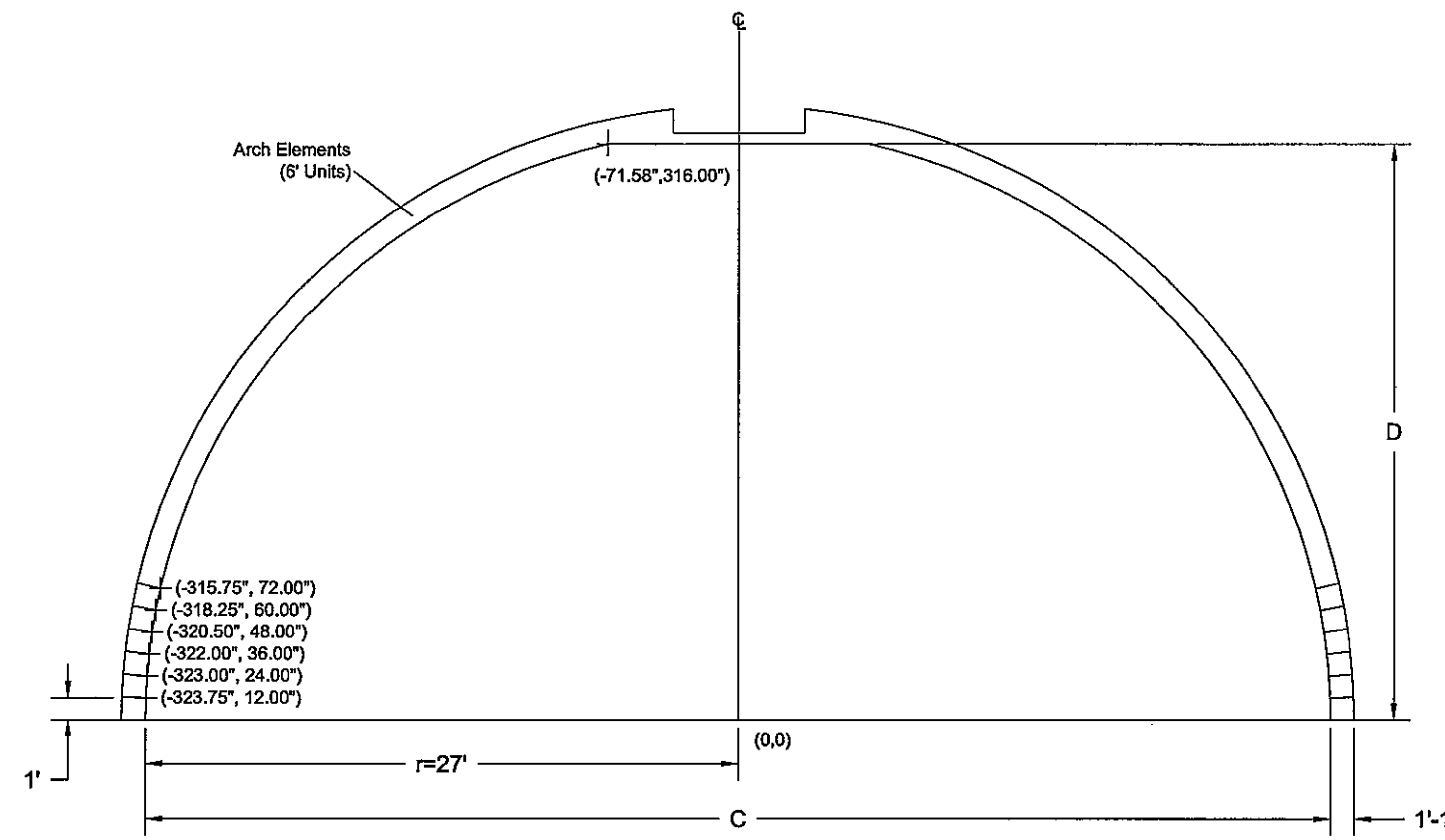

C42T		
Span, C	Rise, D	Waterway Area (Sq. Ft)
41'-7 5/16"	17'-4"	562.4
41'-10 1/16"	18'-4"	604.4
41'-11 9/16"	19'-4"	646.0
42'-0"	20'-4"	688.0
42'-0"	21'-4"	730.0
42'-0"	22'-4"	722.0
42'-0"	23'-4"	814.0
42'-0"	24'-4"	856.0
42'-0"	25'-4"	898.0
42'-0"	26'-4"	940.0

C54T		
Span, C	Rise, D	Waterway Area (Sq. Ft)
52'-7 1/2"	20'-4"	818.45
53'-0 1/2"	21'-4"	871.31
53'-5"	22'-4"	924.55
53'-8"	23'-4"	978.05
53'-10"	24'-4"	1,031.82
53'-11 1/2"	25'-4"	1,085.75
54'-0"	26'-4"	1,139.75

Circle Centered @ (0,0)
$x^2 + y^2 = r^2$

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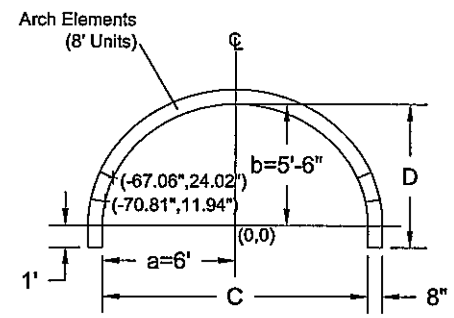
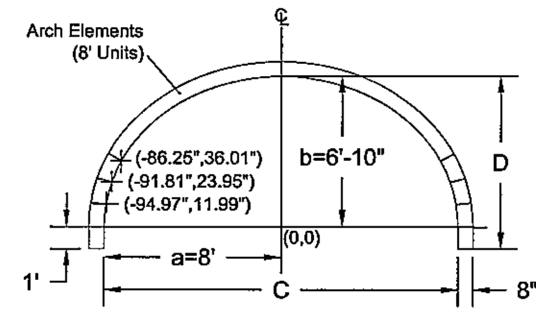
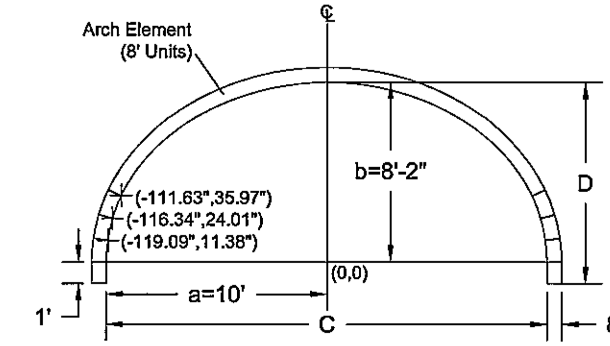


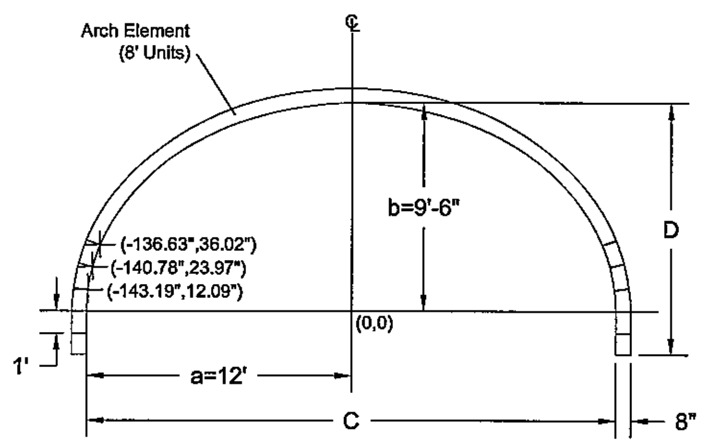
E12		
Span, C	Rise, D	Waterway Area (Sq. Ft)
11'-2 1/8"	3'-6"	28.3
11'-9 5/8"	4'-6"	39.9
12'-0"	5'-6"	51.8
12'-0"	6'-6"	63.8



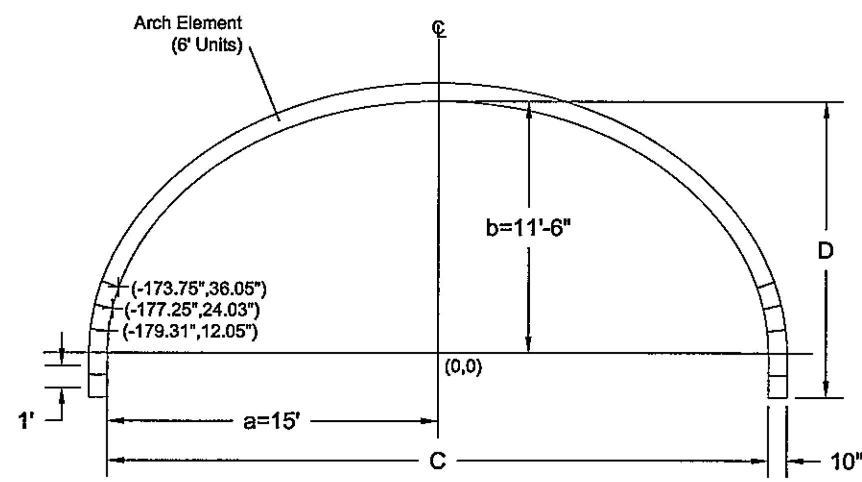
E16		
Span, C	Rise, D	Waterway Area (Sq. Ft)
14'-4 1/2"	3'-10"	39.5
15'-3 5/8"	4'-10"	54.4
15'-9 15/16"	5'-10"	70.0
16'-0"	6'-10"	85.9
16'-0"	7'-10"	101.9



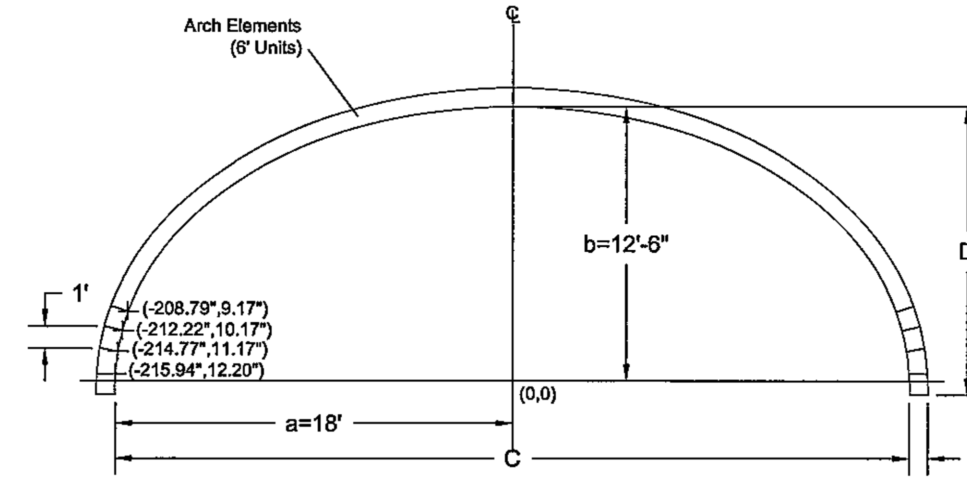
E20		
Span, C	Rise, D	Waterway Area (Sq. Ft)
18'-7 1/4"	5'-2"	69.7
19'-4 11/16	6'-2"	88.7
19'-10 3/16"	7'-2"	108.4
20'-0"	8'-2"	128.3
20'-0"	9'-2"	148.3



E24		
Span, C	Rise, D	Waterway Area (Sq. Ft)
22'-9 1/4"	6'-6"	108.3
23'-5 9/16"	7'-6"	131.5
23'-10 3/8"	8'-6"	155.2
24'-0"	9'-6"	179.1
24'-0"	10'-6"	203.1
24'-0"	11'-6"	227.1



E30		
Span, C	Rise, D	Waterway Area (Sq. Ft)
28'-11 1/2"	8'-6"	181.9
29'-6 1/2"	9'-6"	211.2
29'-10 5/8"	10'-6"	240.9
30'-0"	11'-6"	270.9
30'-0"	12'-6"	300.9
30'-0"	13'-6"	330.9



E36		
Span, C	Rise, D	Waterway Area (Sq. Ft)
34'-8 3/8"	9'-2"	234.8
35'-4 7/16"	10'-2"	269.8
35'-9 17/32"	11'-2"	305.4
35'-11 7/8"	12'-2"	341.3
36'-0"	13'-2"	377.3

Elipse Centered @ (0,0)

$$\left(\frac{x}{a}\right)^2 + \left(\frac{y}{b}\right)^2 = 1$$

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KY TRANSPORTATION CABINET

BEBO E-SERIES GEOMETRY

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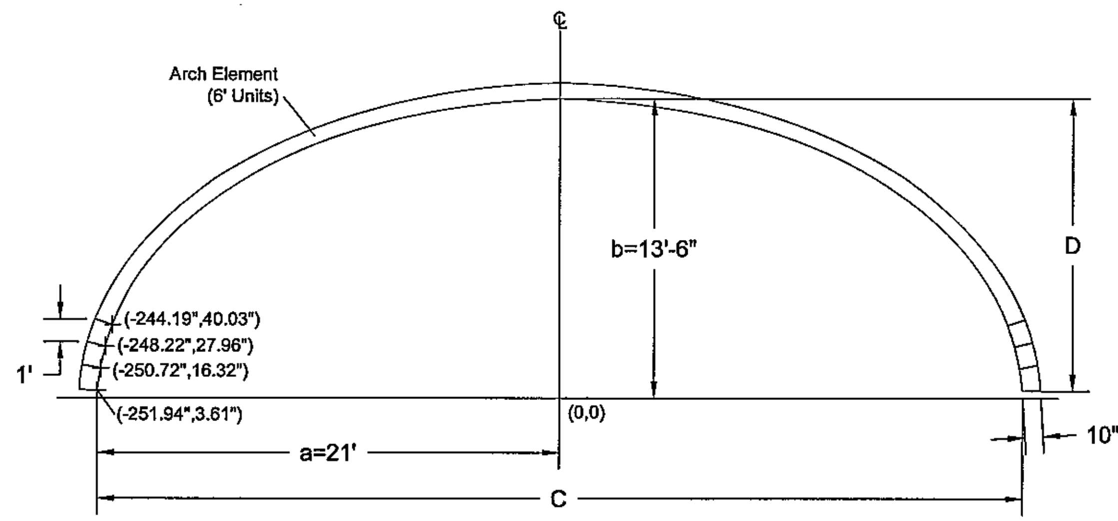
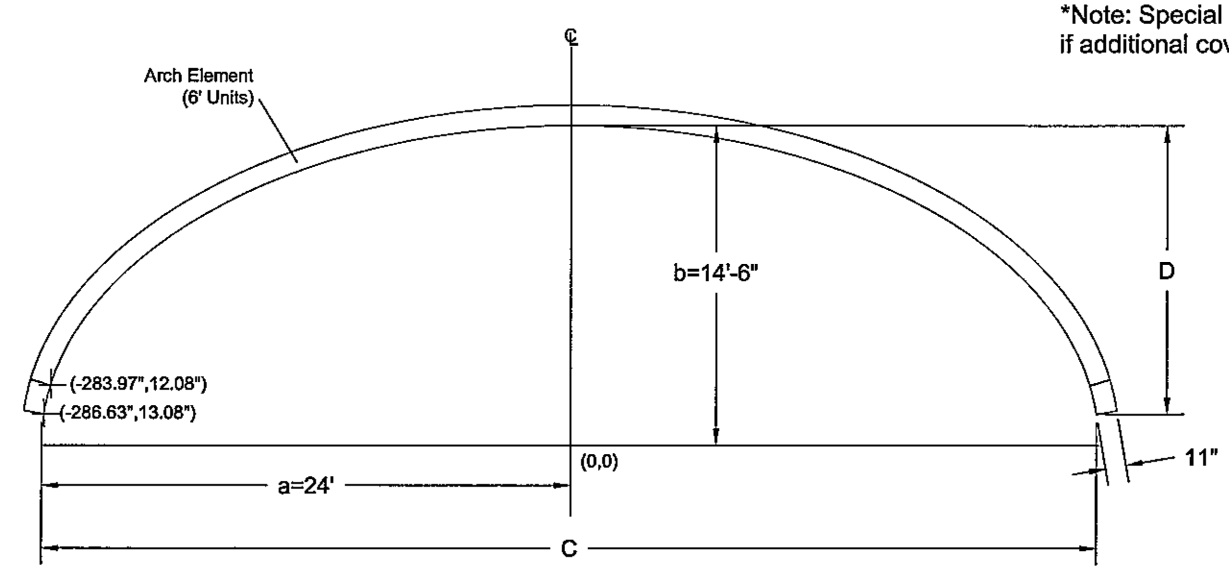
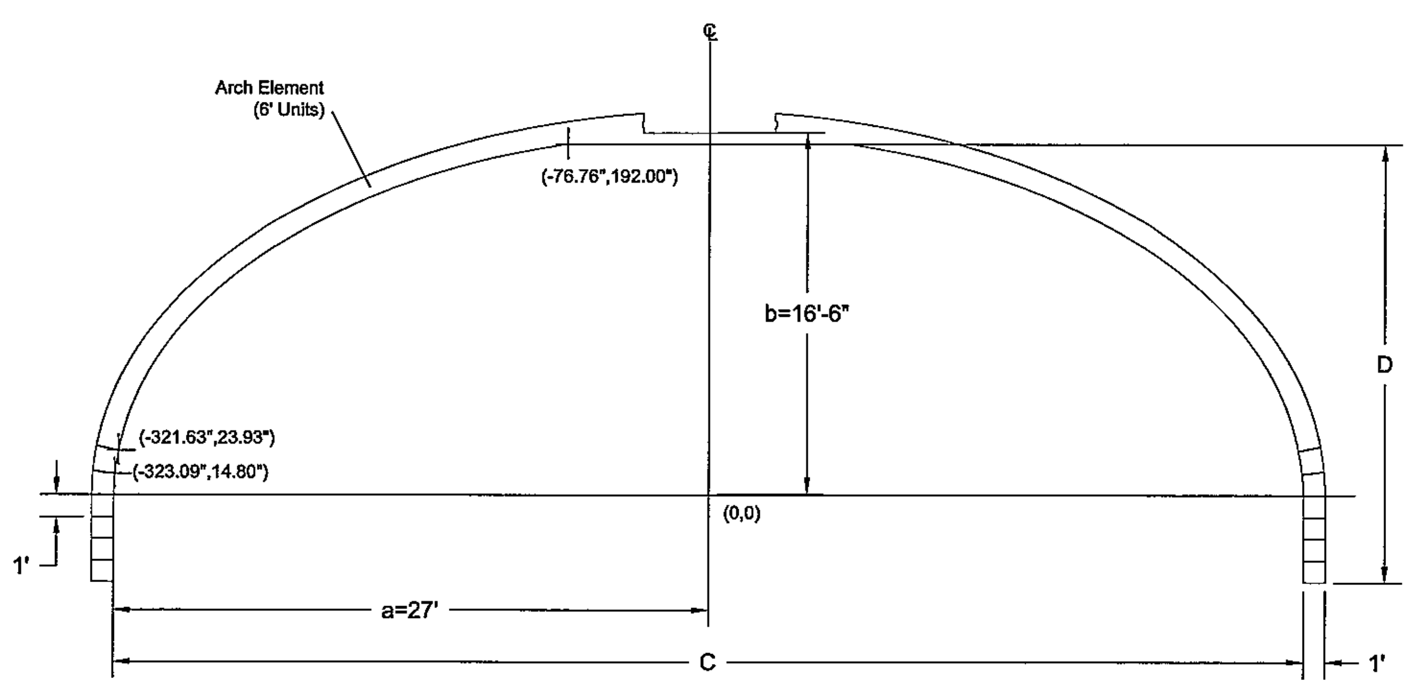


E42		
Span, C	Rise, D	Waterway Area (Sq. Ft)
40'-8 3/8"	10'-2"	306.7
41'-4 7/16"	11'-2"	347.7
41'-9 7/16"	12'-2"	389.3
41'-11 7/8"	13'-2"	431.2



E48		
Span, C	Rise, D	Waterway Area (Sq. Ft)
47'-3 15/16"	12'-1"	431.0
47'-9 1/4"	13'-1"	478.6



E54T		
Span, C	Rise, D	Waterway Area (Sq. Ft)
53'-7 1/4"	14'-0"	587.6
53'-10 13/16"	15'-0"	641.4
54'-0"	16'-0"	695.3
54'-0"	17'-0"	749.3
54'-0"	18'-0"	803.3
54'-0"	19'-0"	857.3
54'-0"	20'-0"	911.3

Elipse Centered @ (0,0)

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BEBO E-SERIES GEOMETRY

JOB NO:
SHEET NO:

Minimum Cover = 1.5'
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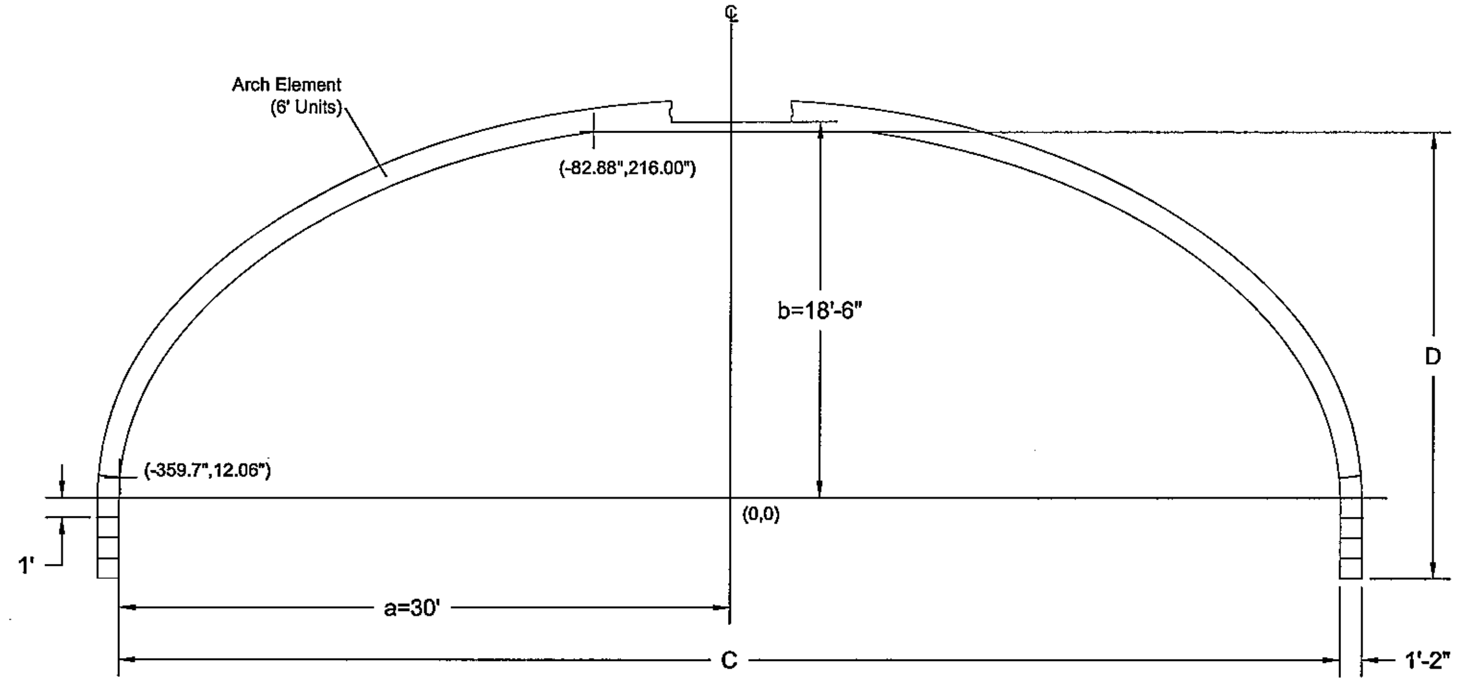
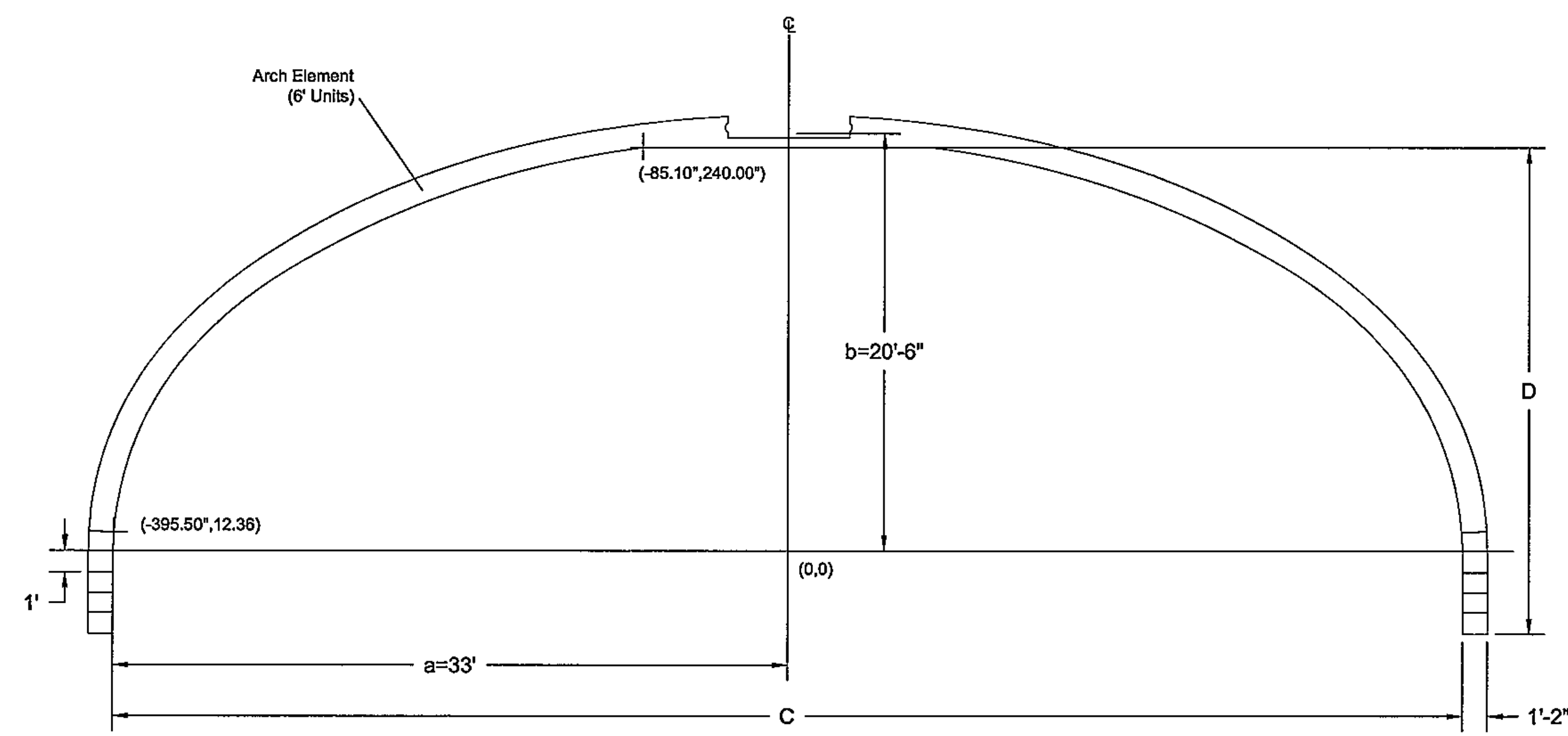


E60T		
Span, C	Rise, D	Waterway Area (Sq. Ft)
59'-10 15/16"	17'-0"	807.1
60'-0"	18'-0"	867.1
60'-0"	19'-0"	927.2
60'-0"	20'-0"	987.2
60'-0"	21'-0"	1047.1
60'-0"	22'-0"	1107.1



E66T		
Span, C	Rise, D	Waterway Area (Sq. Ft)
65'-11"	19'-0"	991.8
66'-0"	20'-0"	1057.8
66'-0"	21'-0"	1123.8
66'-0"	22'-0"	1189.8
66'-0"	23'-0"	1255.8
66'-0"	24'-0"	1321.8

Elipse Centered @ (0,0)

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KY TRANSPORTATION CABINET

BEBO E-SERIES GEOMETRY

JOB NO:

SHEET NO: 5 OF 15

Minimum Cover = 1.5'
Maximum Cover = 15' *

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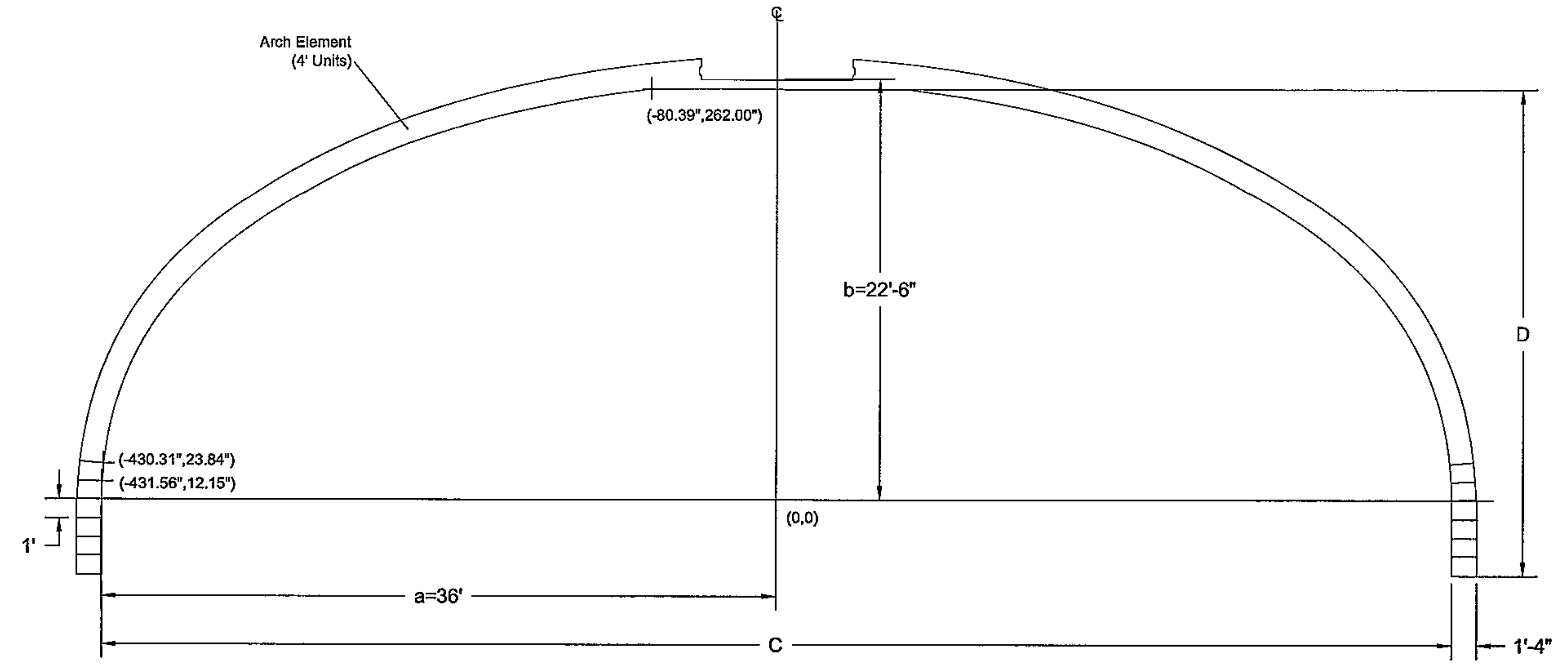
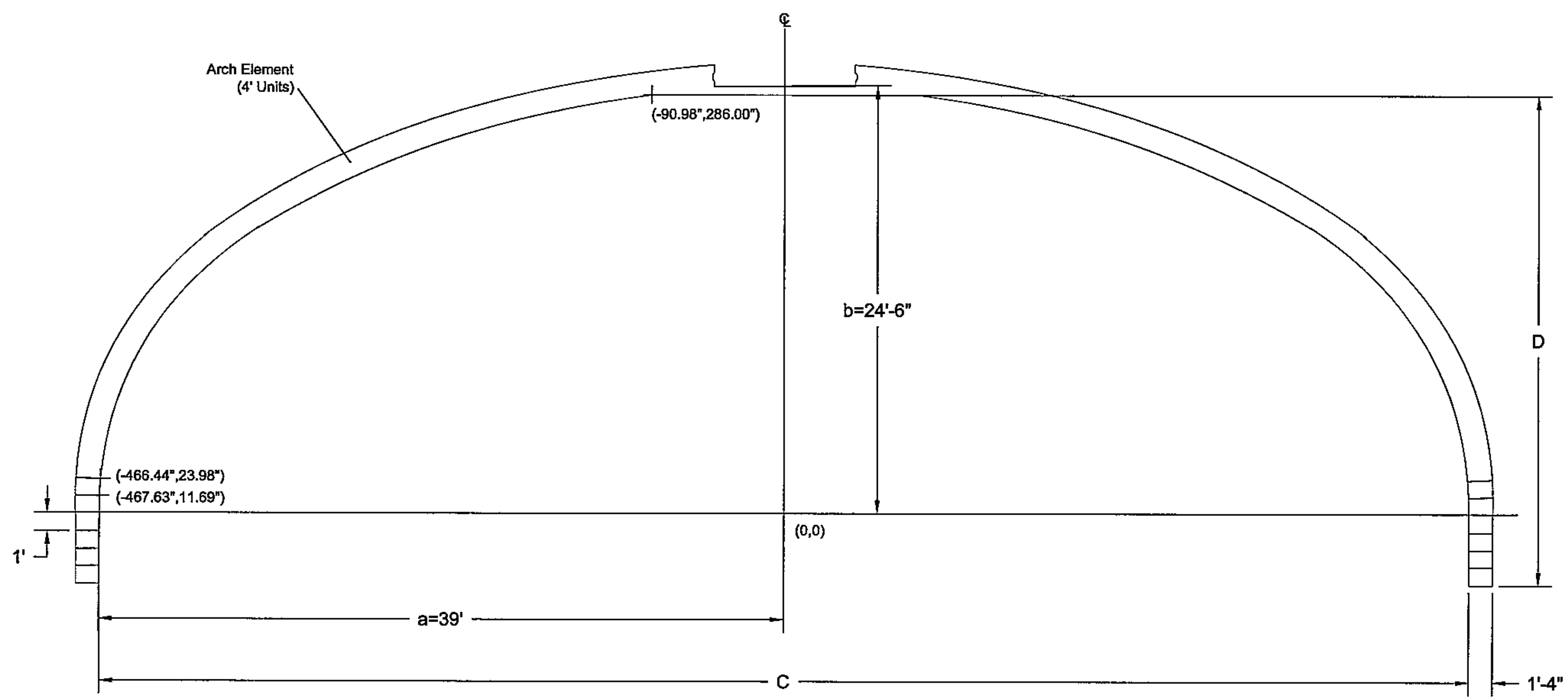


E72T		
Span, C	Rise, D	Waterway Area (Sq. Ft)
71'-8 5/8"	19'-10"	1120.5
71'-11 1/8"	20'-10"	1192.3
72'-0"	21'-10"	1264.3
72'-0"	22'-10"	1336.3
72'-0"	23'-10"	1408.3
72'-0"	24'-10"	1480.3
72'-0"	25'-10"	1552.3



E78T		
Span, C	Rise, D	Waterway Area (Sq. Ft)
77'-8 7/8"	21'-10"	1337.0
77'-11 1/4"	22'-10"	1414.8
78'-0"	23'-10"	1492.8
78'-0"	24'-10"	1570.8
78'-0"	25'-10"	1648.8
78'-0"	26'-10"	1726.8
78'-0"	27'-10"	1804.8

Elipse Centered @ (0,0)

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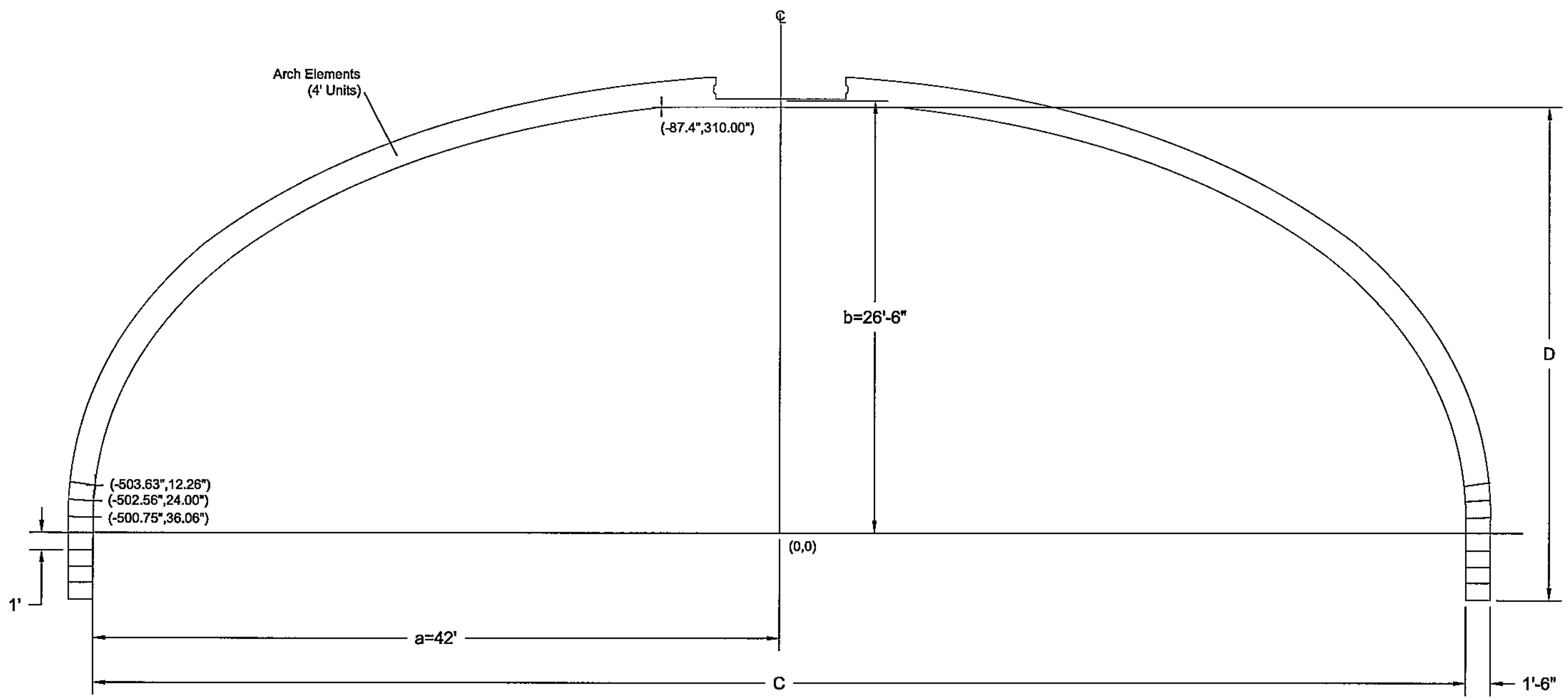

E84T		
Span, C	Rise, D	Waterway Area (Sq. Ft)
83'-5 1/2"	22'-10"	1488.5
83'-9 1/8"	23'-10"	1572.1
83'-11 1/4"	24'-10"	1655.9
84'-0"	25'-10"	1739.9
84'-0"	26'-10"	1823.9
84'-0"	27'-10"	1907.9
84'-0"	28'-10"	1991.9
84'-0"	29'-10"	2075.9

Elipse Centered @ (0,0)

$$\left(\frac{x}{a}\right)^2 + \left(\frac{y}{b}\right)^2 = 1$$

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KY TRANSPORTATION CABINET

BEBO E-SERIES GEOMETRY

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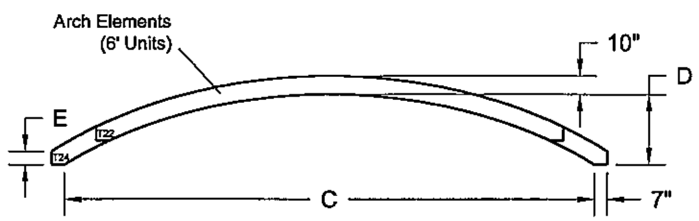
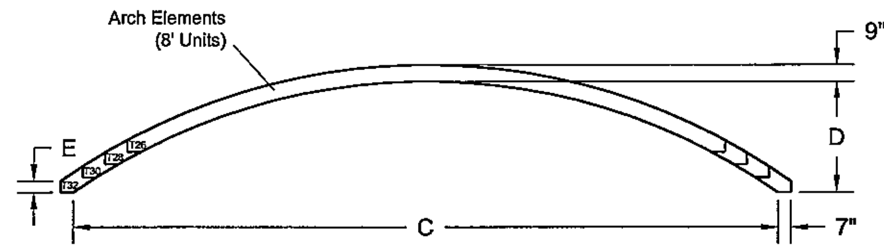
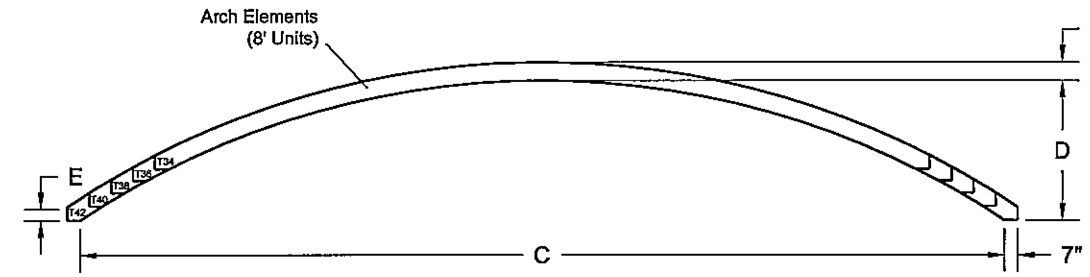


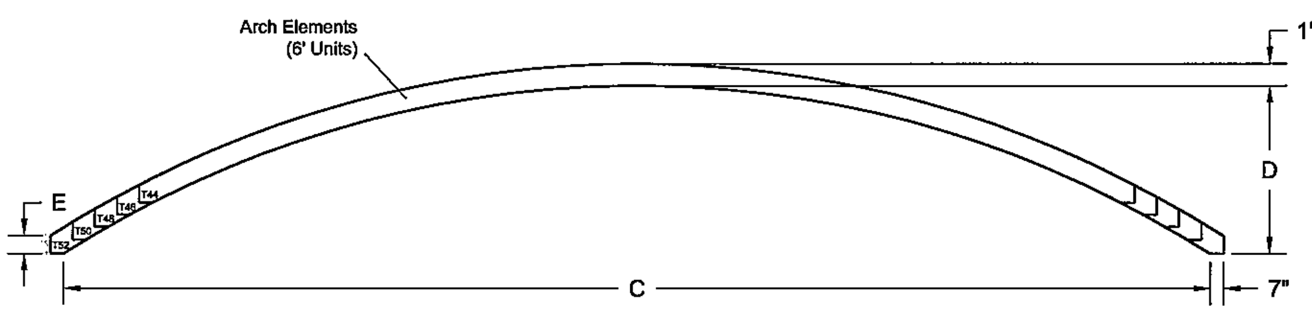
Type	Span, C	Rise, D	E	Waterway Area (Sq. Ft)
T22	22'-0"	2'-7"	7 5/8"	29
T24	24'-0"	3'-2"	7 1/4"	52



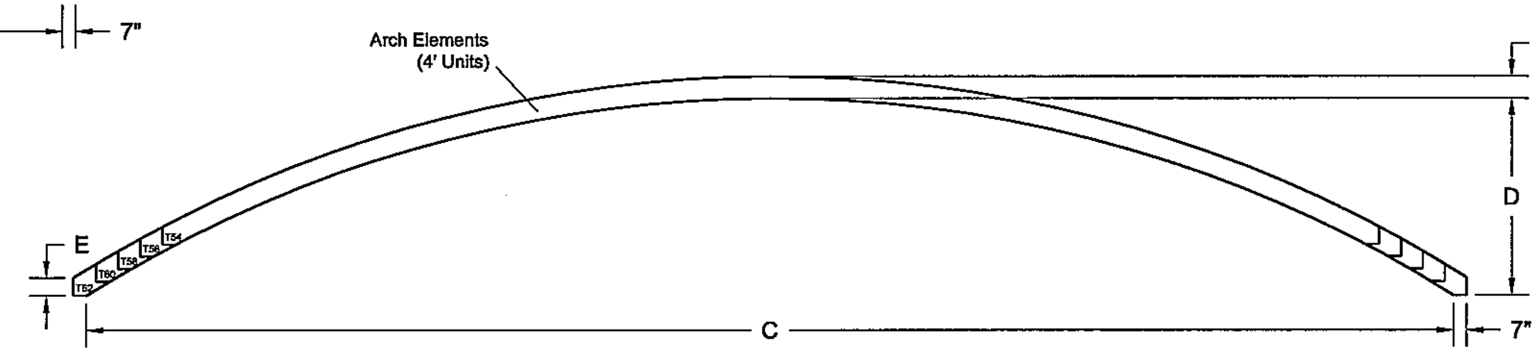
Type	Span, C	Rise, D	E	Waterway Area (Sq. Ft)
T26	26'-0"	3'-2"	6 1/2"	56
T28	28'-0"	3'-9"	6 3/8"	71
T30	30'-0"	4'-4"	6 1/4"	88
T32	32'-0"	5'-0"	6 1/8"	109



Type	Span, C	Rise, D	E	Waterway Area (Sq. Ft)
T34	34'-0"	4'-0"	7 5/8"	91
T36	36'-0"	4'-6"	7 5/8"	110
T38	38'-0"	5'-1"	7 1/4"	130
T40	40'-0"	5'-8"	7 3/8"	154
T42	42'-0"	6'-4"	7 3/8"	180



Type	Span, C	Rise, D	E	Waterway Area (Sq. Ft)
T44	44'-0"	5'-4"	9 7/8"	158
T46	46'-0"	5'-10"	9 7/8"	181
T48	48'-0"	6'-5"	9 7/8"	208
T50	50'-0"	7'-0"	9 3/4"	237
T52	52'-0"	7'-8"	9 3/4"	269



Type	Span, C	Rise, D	E	Waterway Area (Sq. Ft)
T54	54'-0"	6'-8"	9 7/8"	242
T56	56'-0"	7'-2"	9 7/8"	272
T58	58'-0"	7'-9"	9 7/8"	304
T60	60'-0"	8'-4"	9 3/4"	339
T62	62'-0"	9'-0"	9 3/4"	376

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STANDARD DRAWINGS

KY TRANSPORTATION CABINET

BEBO T-SERIES GEOMETRY

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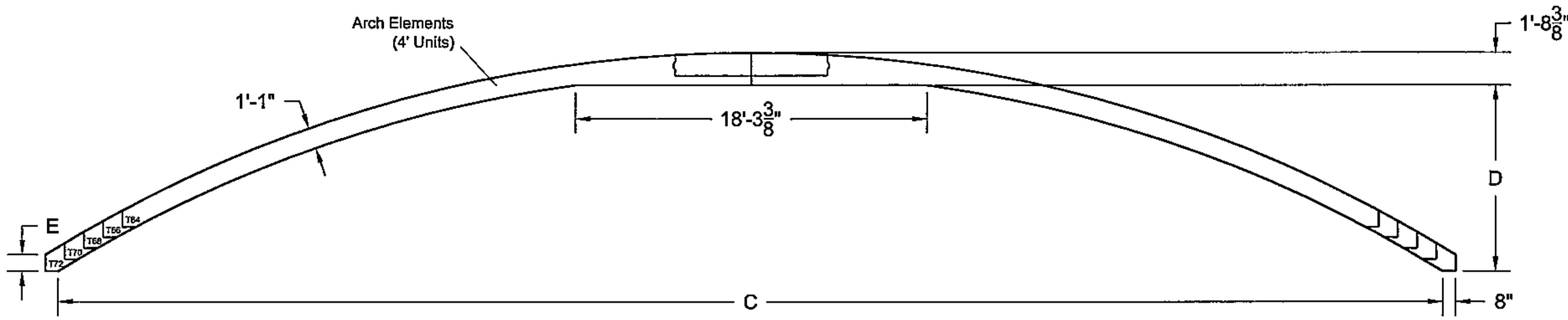
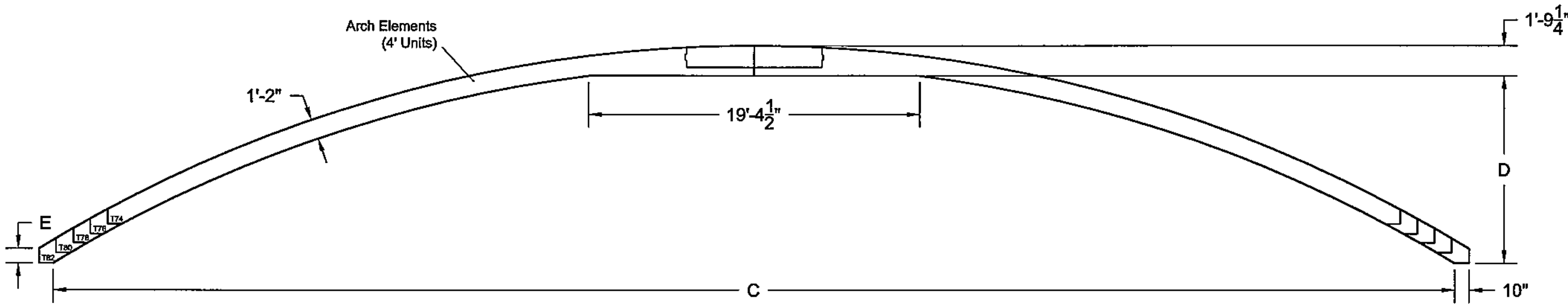


Type	Span, C	Rise, D	E	Waterway Area (Sq. Ft)
T64	64'-0"	7'-5"	10 1/2"	338
T66	66'-0"	7'-11"	10 3/8"	374
T68	68'-0"	8'-6"	10 3/8"	411
T70	70'-0"	9'-1"	10 3/8"	452
T72	72'-0"	9'-8 1/2"	10 3/8"	496



Type	Span, C	Rise, D	E	Waterway Area (Sq. Ft)
T74	74'-0"	8'-9"	10 1/2"	459
T76	76'-0"	9'-4"	10 7/8"	502
T78	78'-0"	9'-10"	10 3/8"	544
T80	80'-0"	10'-5"	10 3/8"	590
T82	82'-0"	11'-0"	10 1/4"	639

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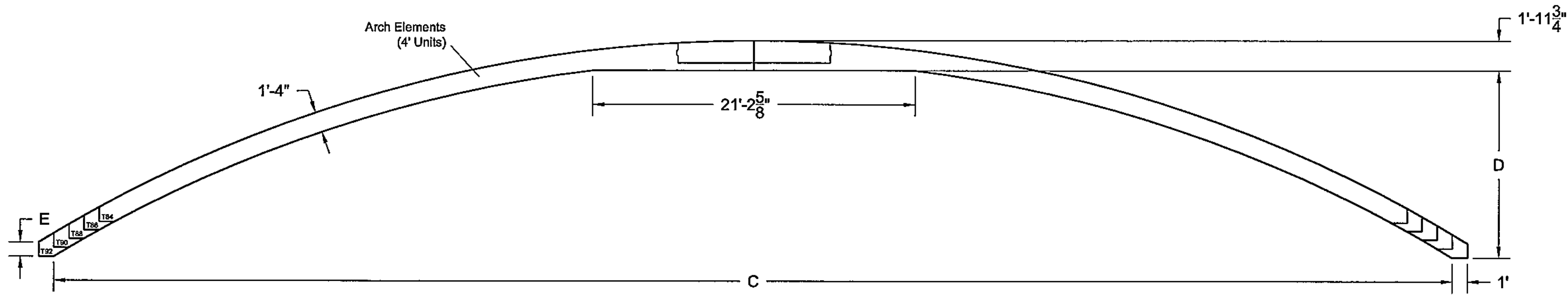
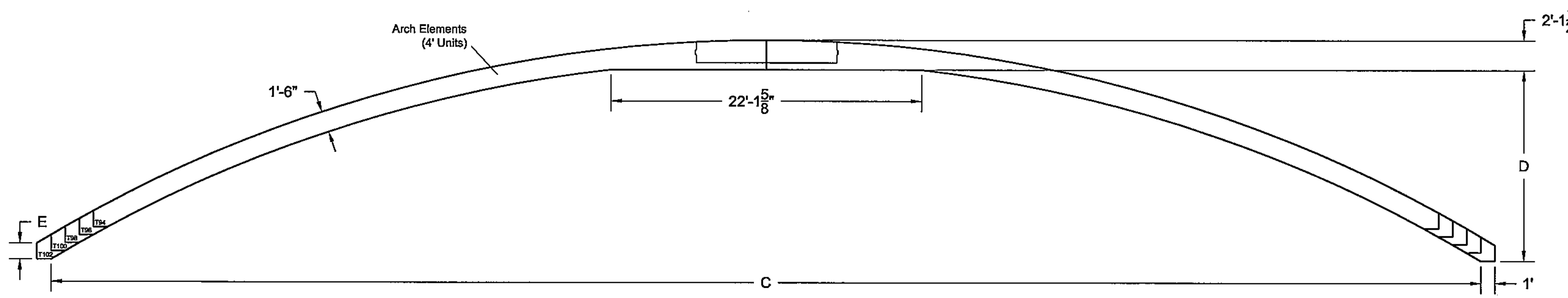


Type	Span, C	Rise, D	E	Waterway Area (Sq. Ft)
T84	84'-0"	10'-0"	11 5/8"	596
T86	86'-0"	10'-7"	11 5/8"	643
T88	88'-0"	11'-2"	11 1/2"	693
T90	90'-0"	11'-9"	11 1/2"	745
T92	92'-0"	12'-4"	11 3/8"	800



Type	Span, C	Rise, D	E	Waterway Area (Sq. Ft)
T94	94'-0"	11'-4"	1'-2"	753
T96	96'-0"	11'-11"	1'-1 7/8"	805
T98	98'-0"	12'-6"	1'-1 7/8"	861
T100	100'-0"	13'-1"	1'-1 3/4"	919
T102	102'-0"	13'-8"	1'-1 3/4"	979

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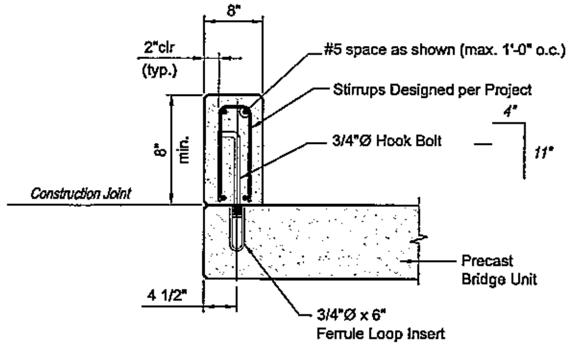
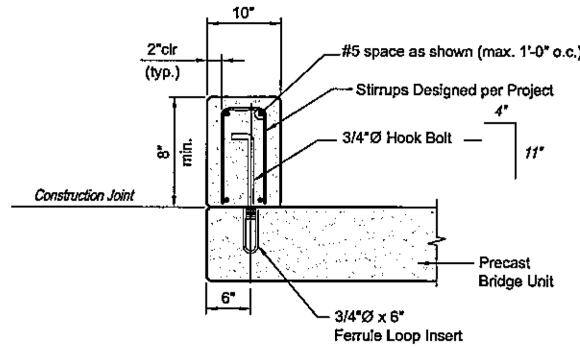
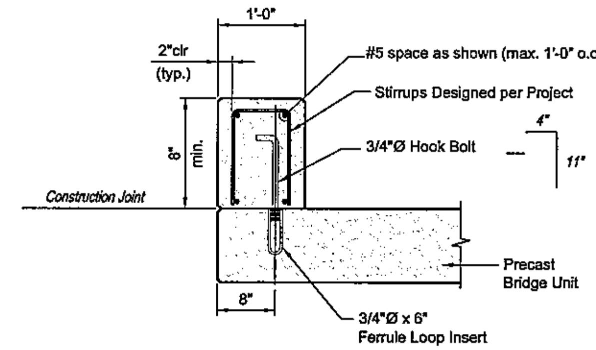


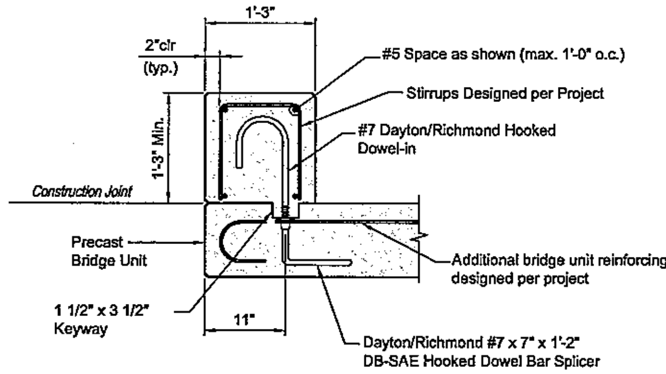
8" ATTACHED HEADWALL



10" ATTACHED HEADWALL



12" ATTACHED HEADWALL

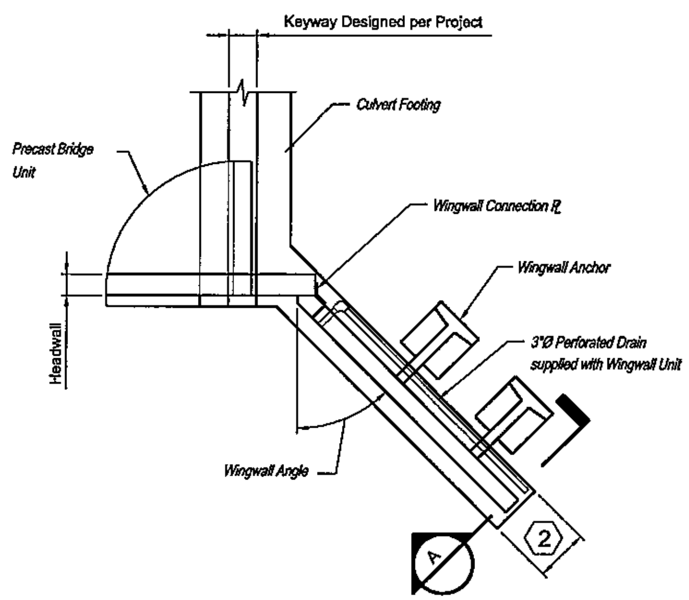


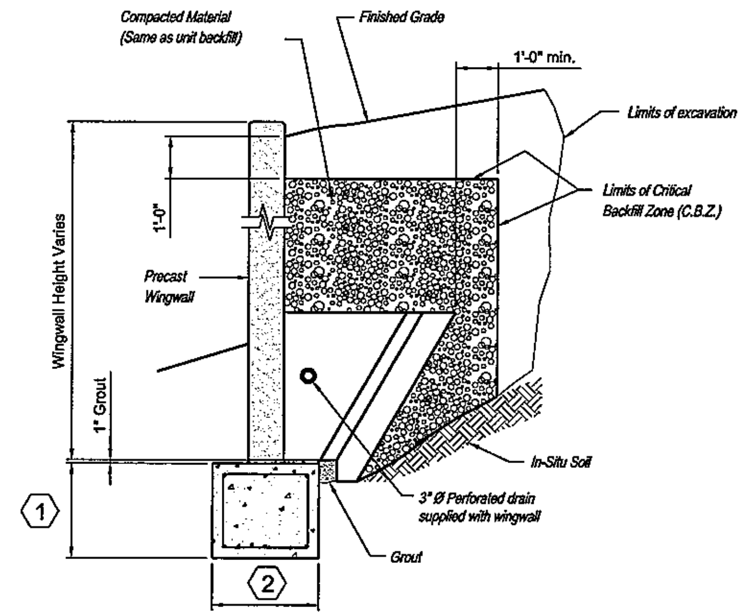
15" ATTACHED HEADWALL FOR GUIDERAIL

PRECAST WINGWALL DETAILS

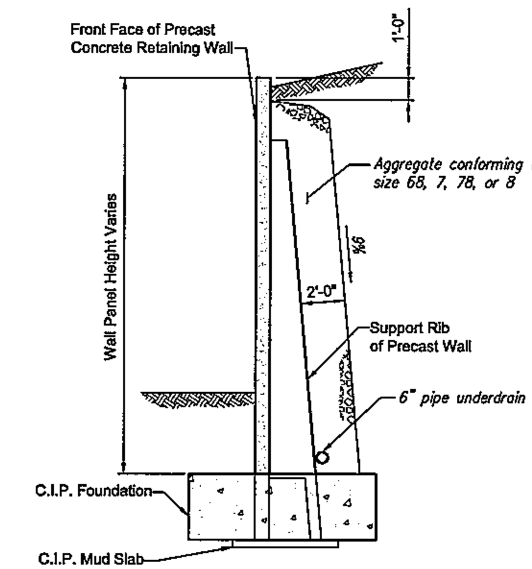
NOTES:

1. Footing depth determined by scour considerations.
2. Wingwall footing width determined by allowable soil bearing.
3. For level installation, top of culvert and wingwall footings at same elevation. For sloping installation, top of footings to be on same plane.
4. Provide bent bars to make culvert and wingwall footing reinforcing continuous.

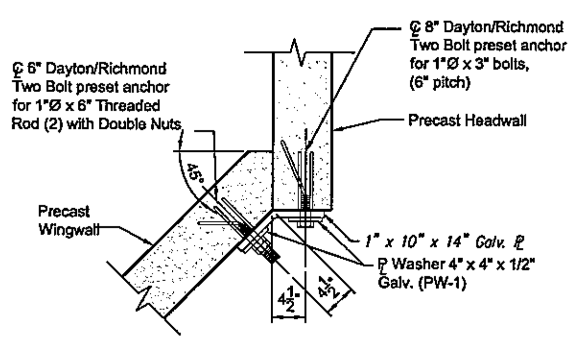




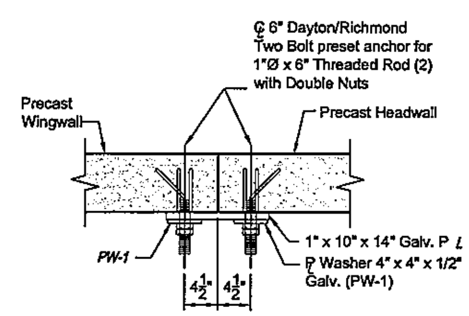
SECTION A



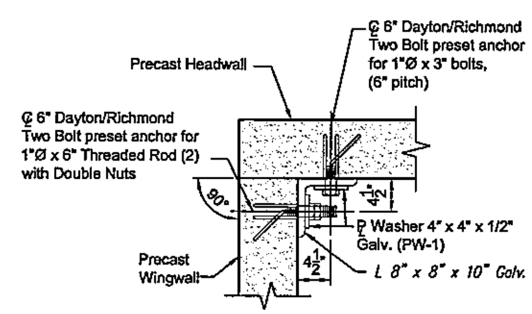
PRECAST MUR EBAL WALL PANEL



45° WINGWALL CONNECTION PLATE DETAIL @ HEADWALL



90° WINGWALL CONNECTION PLATE DETAIL @ HEADWALL



0° WINGWALL CONNECTION PLATE DETAIL @ HEADWALL

Note: Standard wingwall angles are 0, 30, 45, 60, and 90 degrees. Special angles may be fabricated to meet specific site requirements.

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HEADWALL & WINGWALL DETAILS

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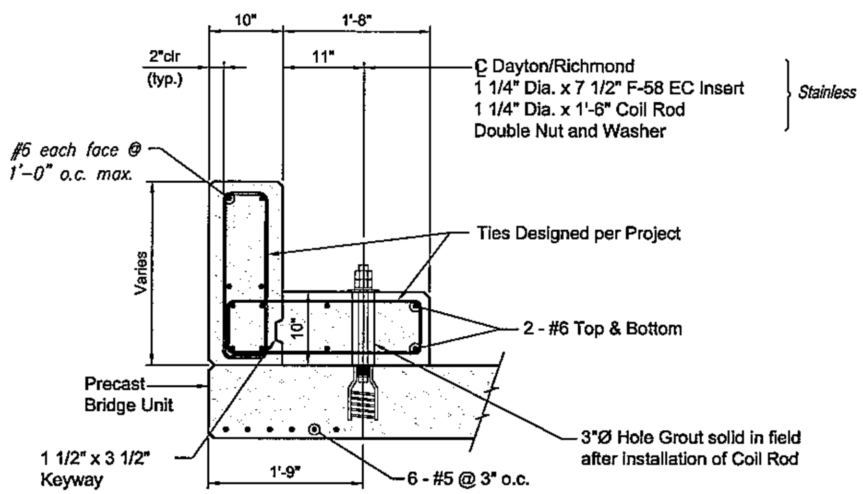
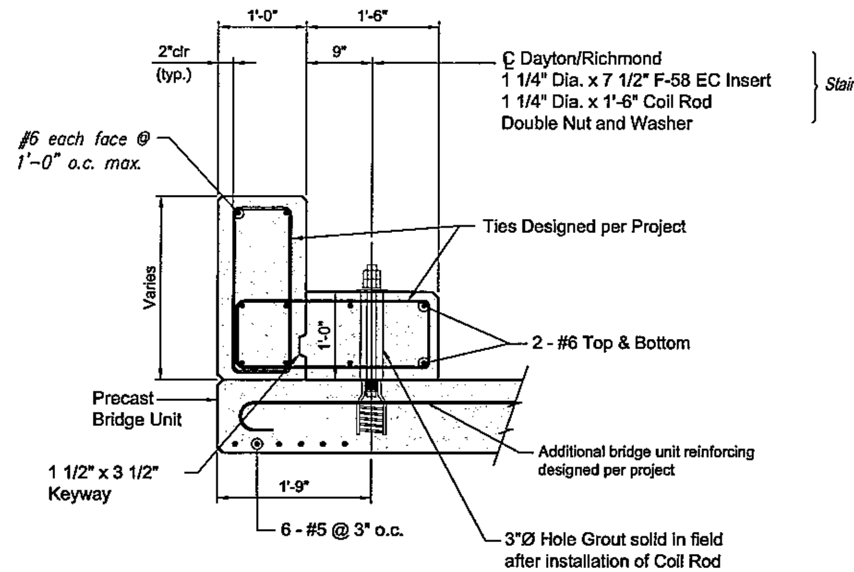
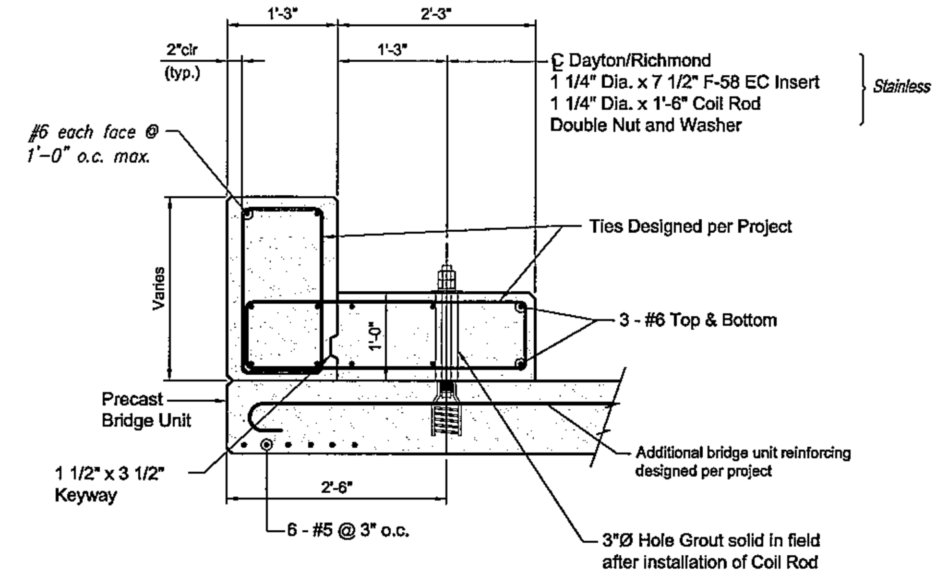


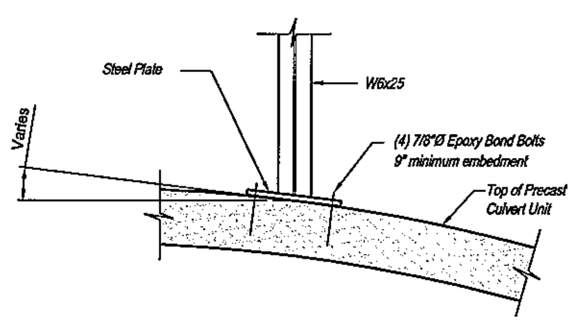
10" DETACHED HEADWALL CONTINUOUS COLLAR

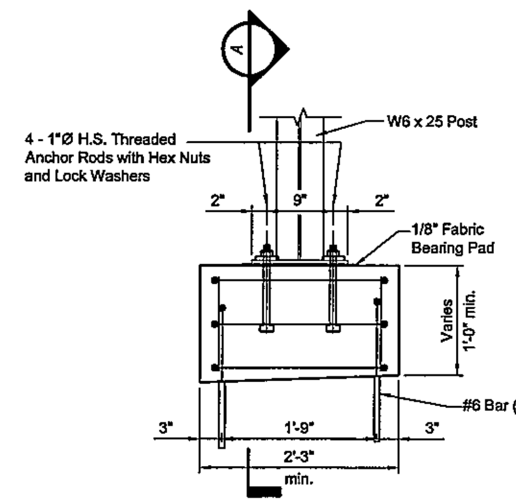


12" DETACHED HEADWALL CONTINUOUS COLLAR

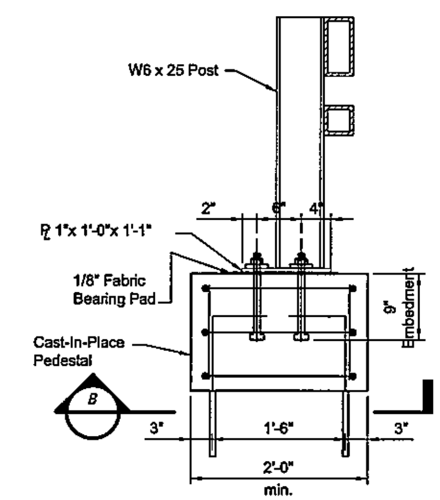


15" DETACHED HEADWALL CONTINUOUS COLLAR - FOR GUIDERAIL



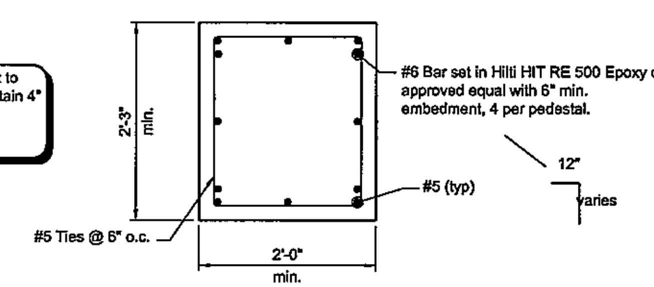


PEDESTAL DETAIL



SECTION A

*Drill holes in Precast Unit to accept a #6 Dowel. Maintain 4" min. clear edge from any culvert joint.



SECTION B

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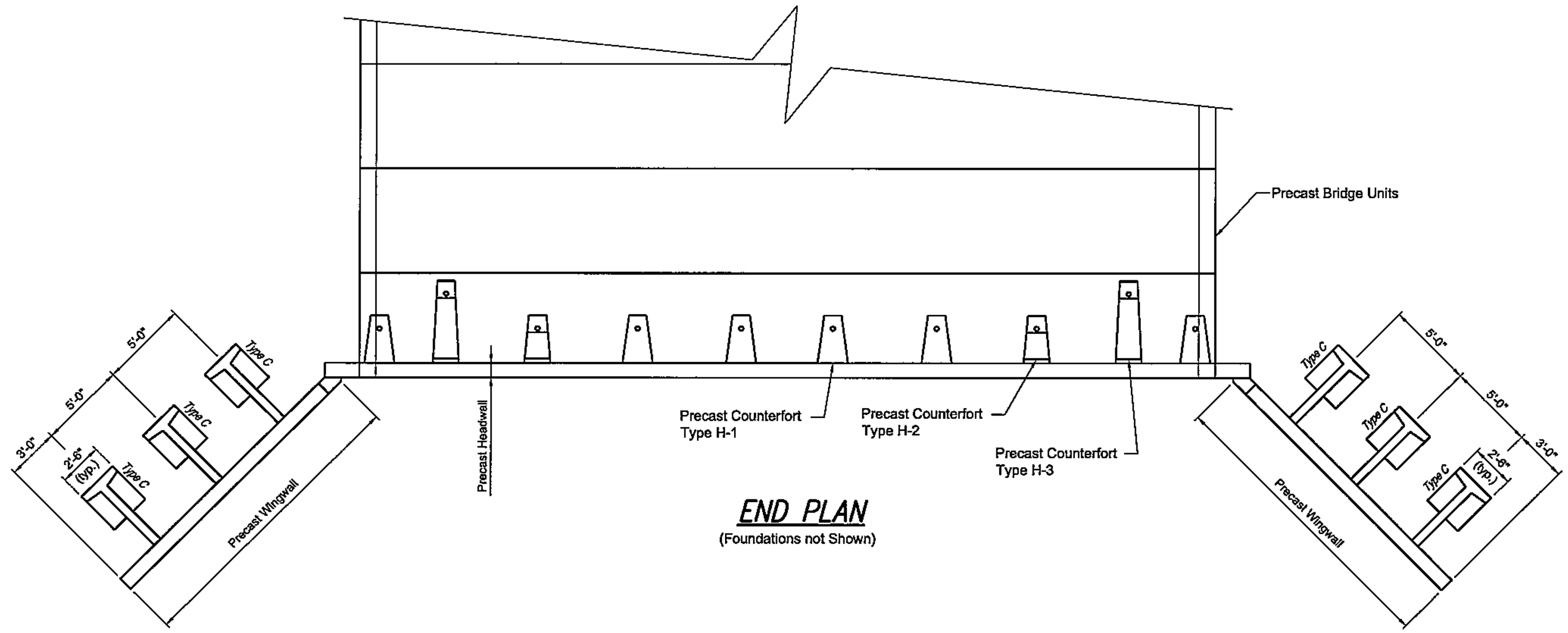
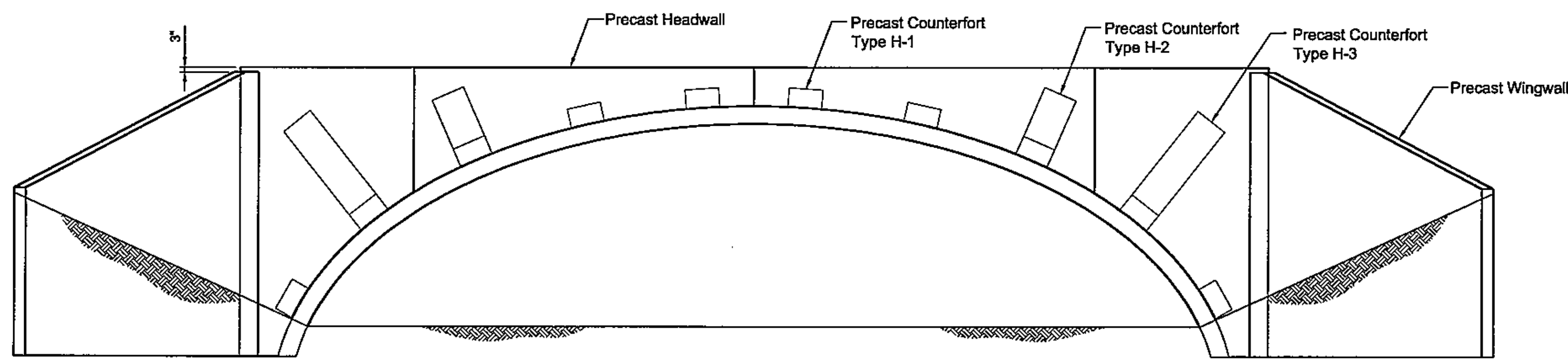
HEADWALL & GUIDERAIL DETAILS

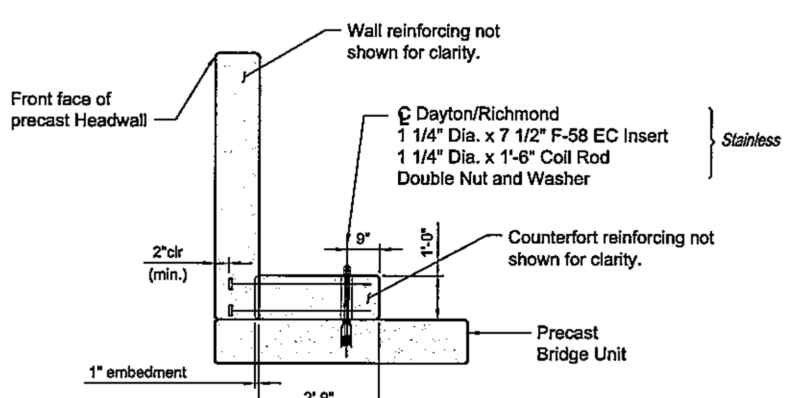
JOB NO.:



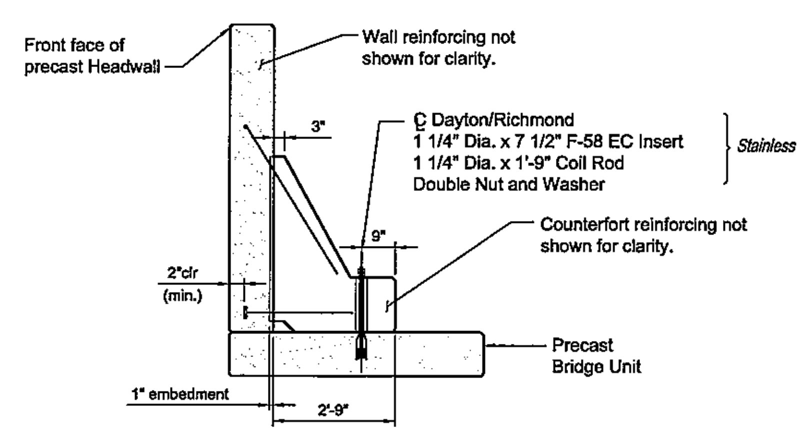
END PLAN
(Foundations not Shown)



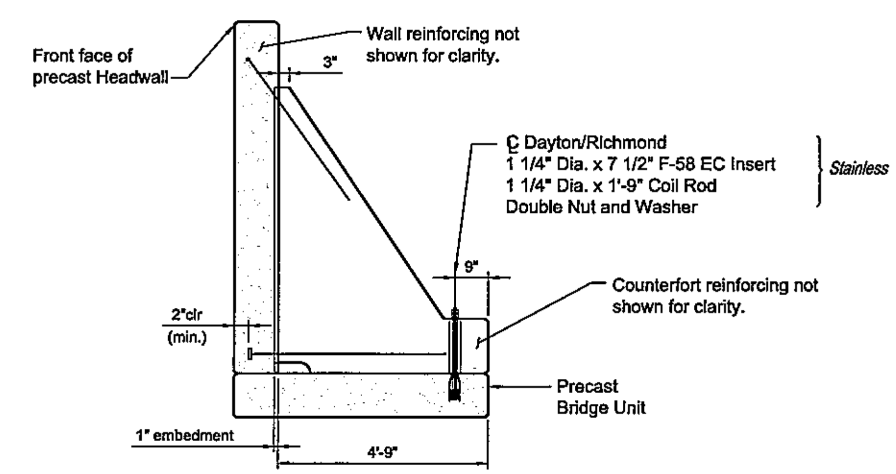
END ELEVATION
(Foundations not Shown)



DETACHED HEADWALL COUNTERFORT TYPE H-1



DETACHED HEADWALL COUNTERFORT TYPE H-2



DETACHED HEADWALL COUNTERFORT TYPE H-3

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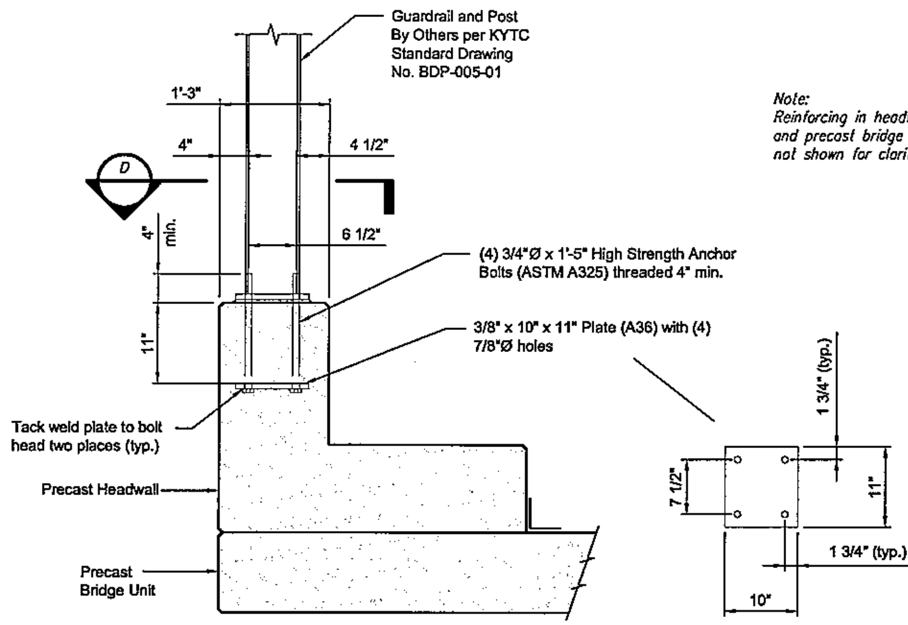
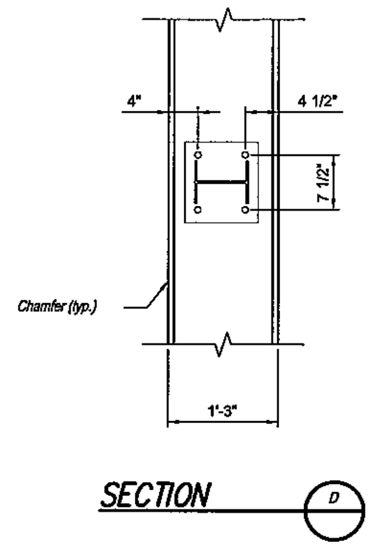
HEADWALL DETAILS

JOB NO:



Note:
Reinforcing in headwall and precast bridge unit not shown for clarity.



TOP MOUNTED GUARDRAIL CONNECTION

PRECAST REQUIREMENTS

1 All materials must be in conformance with KYTC Standard Specifications for Road and Bridge Construction, the KYTC List of Approved Materials, and all applicable ASTM and AASHTO standards.

2 All precast components shall be manufactured by a fabricator approved by KYTC and be in strict compliance with Section 605 of the Kentucky Transportation Cabinet, Department of Highways, Standard Specifications for Road and Bridge Construction.

3 Comply with Section 106.4 of the Standard Specifications for Road and Bridge Construction Buy American Requirement.

4 Precast arch units shall be constructed with one weephole in each leg per KYTC Standard Specifications for Road and Bridge Construction.

5 Precast components shall be designed according to the current version of the AASHTO LRFD Bridge Design Specifications. Arch units shall be designed to support HL-93 Live Load.

CONSTRUCTION REQUIREMENTS

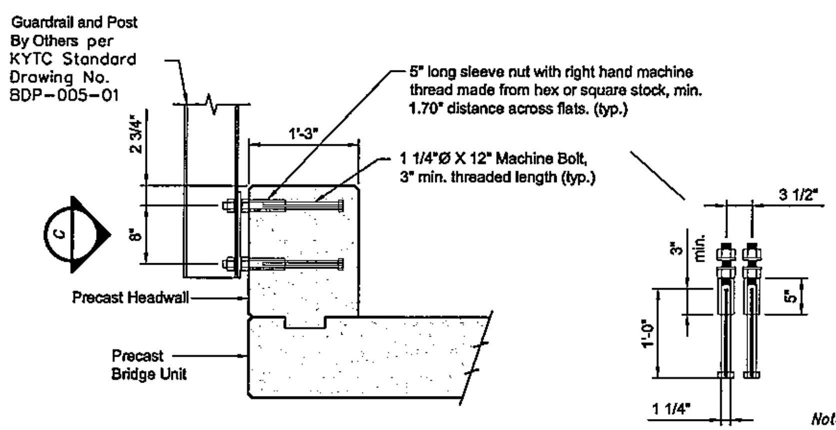
1 Footings - The bridge units and wingwalls shall be installed on either precast or cast-in-place concrete footings. The design size and elevation of the footings shall be as specified on the plans. A keyway shall be formed in the top surface of the bridge footing with depth, width and location as specified on the plans. No keyway is required in the wingwall footings, unless otherwise specified on the plans. The footings shall be given a smooth float finish and shall reach the required compressive strength before placement of the bridge and wingwall elements. The completed footing surface shall be constructed in accordance with grades shown on the plans. When tested with a 10 foot straight edge, the surface shall not vary more than 1/4 inch in 10 feet. If a precast concrete footing is used, the contractor shall prepare a 4 inch thick base layer of compacted granular material the full width of the footing prior to placing the precast footing.

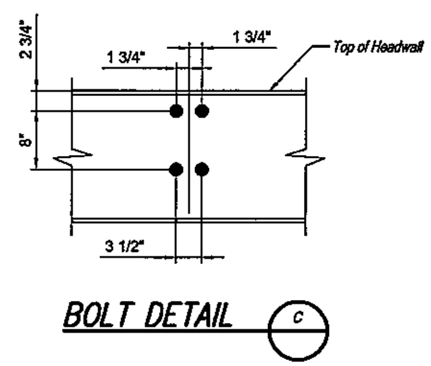
2 Placement of the Bridge Units, Wingwalls and Headwalls - The bridge units, wingwalls and headwalls shall be placed as shown on the Engineer's plan drawings. Special care shall be taken in setting the elements to the true line and grade. The bridge units and wingwalls shall be set on masonite or steel shims or mortar leveling pads. A minimum gap of 1/2 inch shall be provided between the footing and the bottom of the bridge's vertical legs or the wingwall. The gap shall be filled with non-shrink cement grout with a minimum 28-day compressive strength of 5000 psi. If units have been set with temporary ties (cables, bars, etc.) grout must attain a minimum compressive strength of 2500 psi before ties may be removed.

3 External Protection of Joints - The butt joint made by two adjoining bridge units shall be covered with a 7/8" x 1 3/8" preformed bituminous joint sealant and a minimum of a 9 inch wide joint wrap. The surface shall be free of dirt before applying the joint material. A primer compatible with the joint wrap to be used shall be applied for a minimum width of nine inches on each side of the joint. The external wrap shall be either EZ-WRAP RUBBER by PRESS-SEAL GASKET CORPORATION, SEAL WRAP by MAR MAC MANUFACTURING CO. INC. or approved equal. The joint shall be covered continuously from the bottom of one bridge section leg, across the top of the arch and to the opposite bridge section leg. Any laps that result in the joint wrap shall be a minimum of six inches long with the overlap running downhill.

In addition to the joints between bridge units, the joint between the end bridge unit and the headwall shall also be sealed as described above. If precast wingwalls are used, the joint between the end bridge unit and the wingwall shall be sealed with a 2'-0" strip of filter fabric. Also, if lift holes are formed in the arch units, they shall be primed and covered with a 9" x 9" square of joint wrap.

During the backfilling operation, care shall be taken to keep the joint wrap in its proper location over the joint.





Note:
Reinforcing in headwall and precast bridge unit not shown for clarity.

SIDE MOUNTED GUARDRAIL CONNECTION

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GUIDERAIL ATTACHMENT DETAILS

JOB NO:

1 BACKFILL REQUIREMENTS FOR BEBO E SERIES AND C SERIES ARCHES

1.1 BACKFILL COMPACTION

1.1.1 MECHANICAL TAMPERS OR APPROVED COMPACTING EQUIPMENT SHALL BE USED TO COMPACT ALL BACKFILL AND EMBANKMENT IMMEDIATELY ADJACENT TO EACH SIDE AND OVER THE TOP OF EACH BRIDGE UNIT UNTIL IT IS COVERED TO A MINIMUM DEPTH OF ONE FOOT, UNLESS THE DESIGN FILL HEIGHT IS LESS THAN 1'-0". THE BACKFILL WITHIN THE CRITICAL BACKFILL ZONE (SHOWN IN THE DIAGRAMS BELOW) SHALL BE PLACED IN LIFTS OF EIGHT INCHES OR LESS (LOOSE DEPTH). HEAVY COMPACTION EQUIPMENT SHALL NOT BE OPERATED IN THIS AREA OR OVER THE BRIDGE UNTIL IT IS COVERED TO A DEPTH OF ONE FOOT, UNLESS THE DESIGN FILL HEIGHT IS LESS THAN 1'-0".

1.1.2 LIGHTWEIGHT DOZERS AND GRADERS MAY BE OPERATED OVER BRIDGE UNITS HAVING ONE FOOT OF COMPACTED COVER, BUT HEAVY EARTH MOVING EQUIPMENT (LARGER THAN A D-4 DOZER WEIGHING IN EXCESS OF 12 TONS AND HAVING TRACK PRESSURES OF EIGHT PSI OR GREATER) SHALL REQUIRE TWO FEET OF COVER UNLESS THE DESIGN COVER IS LESS THAN TWO FEET. IN NO CASE SHALL EQUIPMENT OPERATING IN EXCESS OF THE DESIGN LOAD (HS20 OR HS25) BE PERMITTED OVER THE BRIDGE UNITS UNLESS APPROVED BY CON/SPAN®.

1.1.3 ANY ADDITIONAL FILL AND SUBSEQUENT EXCAVATION REQUIRED TO PROVIDE THIS MINIMUM COVER SHALL BE MADE AT NO ADDITIONAL COST TO THE PROJECT.

1.1.4 AS A PRECAUTION AGAINST INTRODUCING UNBALANCED STRESSES IN THE BRIDGE, WHEN PLACING BACKFILL AT NO TIME SHALL THE DIFFERENCE BETWEEN THE HEIGHTS OF FILL ON OPPOSITE SIDES OF THE BRIDGE EXCEED 24".

1.1.5 BACKFILL IN FRONT OF WINGWALLS SHALL BE CARRIED TO GROUND LINES SHOWN IN THE PLANS.

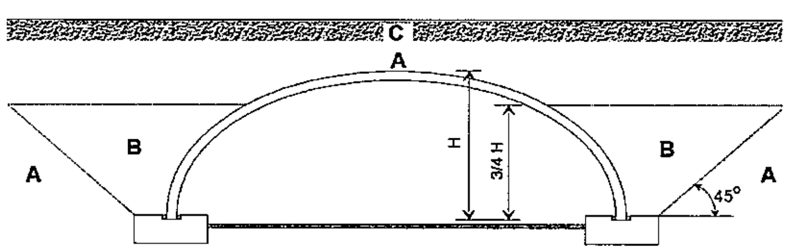
1.1.6 FOR FILL HEIGHTS OVER 12 FEET, NO BACKFILLING MAY BEGIN UNTIL A BACKFILL COMPACTION TESTING PLAN HAS BEEN COORDINATED WITH AND APPROVED BY CON/SPAN® BRIDGE SYSTEMS. COST OF THE BACKFILL COMPACTION TESTING SHALL BE INCLUDED IN THE COST OF THE PRECAST UNITS. THIS INCLUDED COST APPLIES ONLY TO PROJECTS WITH FILL HEIGHTS OVER 12 FEET (AS MEASURED FROM TOP CROWN OF ARCH TO FINISHED GRADE).

TYPICAL USCS MATERIALS	Group	Sub-Group	Per Cent Passing U.S. Sieve No. 10 [2mm]	40 [0.4mm]	200 [0.074mm]	Character of Fraction Passing No. 40 Sieve Liquid Limit	Plasticity Index	Group Index No. 1)	Soil Description
GW, GP, SP	A-1			50 max.	25 max.		6 max.	0	Well-graded gravel or sand; may include fines
GM, SW, SP, SM		A-1-a	50 max.	30 max.	15 max.		6 max.	0	Largely gravel but can include sand and fines
		A-1-b		50 max.	25 max.		6 max.	0	Gravelly sand or graded sand; may include fines
GM, SM, ML, SP, GP	A-2				35 max.			0 to 4	Sands and gravels with excessive fines
SC, GC, GM		A-2-4			35 max.	40 max.	10 max.	0	Sands, gravels with low-plasticity silt fines
SC, GC		A-2-5			35 max.	41 min.	10 max.	0	Sands, gravels with plastic silt fines
		A-2-6			35 max.	40 max.	11 min.	4 max.	Sands, gravels with clay fines
SC, GC		A-2-7			35 max.	41 min.	11 min.	4 max.	Sands, gravels with highly plastic clay fines
SP,SM,SW	A-3			51 min.	10 max.		Nonplastic	0	Fine sands
ML, SM, SC	A-4				36 min.	40 max.	10 max.	0 max.	Low-compressibility silts
MH, OH, ML, OL	A-5				36 min.	41 min.	10 max.	12 max.	High-compressibility silts
CL, ML, OL	A-6				36 min.	40 max.	11 min.	16 max.	Low-to-medium-compressibility clays
	A-7				36 min.	41 min.	11 min.	20 max.	High-compressibility clays
OL, CH, MH, OH, CL, ML		A-7-5			36 min.	41 min.	11 min.	20 max.	High-compressibility silty clays
OH, CH, MH, CL, ML, OL		A-7-6			36 min.	41 min.	11 min.	20 max.	High compressibility, high-volume-change clays
PT, OH	A-8								Peat, highly organic soils

Acceptable Soils — Non-acceptable Soils

1.2 BACKFILL ZONES

1.2.1 ZONE A: EXISTING SOIL, CONSTRUCTED EMBANKMENT OR OVERFILL.
1.2.2 ZONE B: FILL WHICH IS DIRECTLY ASSOCIATED WITH PRECAST CONCRETE ARCH INSTALLATION.
1.2.3 ZONE C: ROAD STRUCTURE.



1.3 REQUIRED FILL PROPERTIES

1.3.1 ZONE A

1.3.1.1 ZONE A REQUIRES NATURAL GROUND OR FILL MATERIAL WITH SPECIFICATIONS AND FILLING AS WELL AS COMPACTING PROCEDURES EQUAL TO THAT FOR NORMAL ROAD EMBANKMENTS.

1.3.1.2 NATURAL GROUND IS TO BE SUFFICIENTLY STABLE TO ALLOW EFFECTIVE SUPPORT TO THE PRECAST CONCRETE ARCH UNITS. AS A GUIDE, THE EXISTING NATURAL GROUND SHOULD BE OF SIMILAR QUALITY AND DENSITY TO ZONE B MATERIAL FOR A MINIMUM LATERAL DIMENSION OF ONE ARCH SPAN OUTSIDE OF THE ARCH FOOTING.

1.3.2 ZONE B

1.3.2.1 GENERALLY, SOILS THAT MEET THE FOLLOWING BASIC REQUIREMENTS ARE ACCEPTABLE:

- $\Phi' \geq 30°$ ANGLE OF INTERNAL (COMPACTED STATE)FRICTION, IN
- $WL \leq 40\%$ (LIQUID LIMIT)
- $IP \leq 10\%$ (PLASTICITY INDEX)

1.3.2.2 SOILS SHALL BE REASONABLY FREE OF ORGANIC MATTER, AND, NEAR CONCRETE SURFACES, FREE OF STONES LARGER THAN 3 INCHES IN DIAMETER.

1.3.2.3 MATERIALS WITH GRADATIONS THAT FALL WITHIN THE FOLLOWING LIMITS (SHADED AREA OF FIGURE C2), NORMALLY FULFILL THE ABOVE BASIC REQUIREMENTS:

SOILS SHOULD HAVE A WATER CONTENT THAT ALLOWS TO OBTAIN THE REQUIRED COMPACTION. THIS IS ESPECIALLY CRITICAL FOR SOILS OF THE USCS GROUPS SM-ML AND SM-SC.
SOILS THAT EXCEED THE GRADATION LIMITS AT THE OPENINGS ≤ 0.020 MM (SILT/CLAY FRACTION) OF THE USCS GROUPS GC-CL, SC-CL, ML AND CL-ML CAN STILL BE ACCEPTABLE, BUT NEED TO BE LABORATORY TESTED FOR THE ABOVE BASIC REQUIREMENTS.
THE FOLLOWING USCS SOIL GROUPS ARE NOT ACCEPTABLE AS BACKFILL MATERIAL IN THEIR NATURAL STATE:

- GC-CH (GRAVEL WITH HIGH PLASTICITY CLAY)
- SC-CH (SAND WITH HIGH PLASTICITY CLAY)
- CL (GRAVELLY AND/OR SANDY, CLAYEY SILT)
- OL (GRAVELLY AND/OR SANDY, ORGANIC SILT)
- CH (GRAVELLY AND/OR SANDY, SILTY CLAY)
- OH (GRAVELLY AND/OR SANDY ORGANIC SILTY CLAY)
- MH (GRAVELLY AND/OR SANDY HIGH PLASTICITY SILT)

MATERIAL OF THE SOIL GROUPS GC-CH AND SC-CH CAN BE IMPROVED ("SOIL CEMENT") BY ADDING CEMENT OR LIME AND USED FOR BACKFILLING. HOWEVER, SPECIAL KNOW-HOW AND TESTING WILL BE NECESSARY.
THE SUITABILITY OF BACKFILL MATERIAL CAN ALSO BE DETERMINED USING AASHTO DESIGNATION M 145-87. IN GENERAL, SOILS GROUPS A-1, A-2, A-3 AND A-4 ARE ACCEPTABLE (SEE TABLE BELOW, BUREAU OF PUBLIC ROADS CLASSIFICATION).

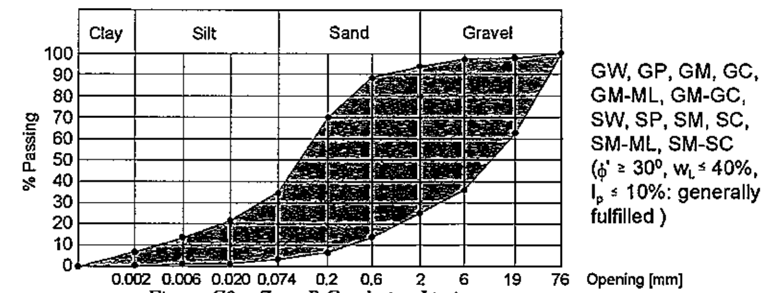


Figure C2: Zone B Gradation Limits

1) DETERMINATION OF GROUP INDEX NO.
GROUP INDEX $= (F - 35) \cdot [0.2 + 0.005 \cdot (LL - 40)] + 0.01 \cdot (F - 15) \cdot (PI - 10)$
IN WHICH: F = PERCENTAGE PASSING NO. 200 (0.074 MM) SIEVE, EXPRESSED AS A WHOLE NUMBER. THIS PERCENTAGE IS BASED ONLY ON THE MATERIAL PASSING THE 3-IN (75 MM) SIEVE.
LL = LIQUID LIMIT
PI = PLASTICITY INDEX

- INDEX NO. 0 - 4 INDICATES A "GOOD" MATERIAL
- INDEX NO. 5 - 14 INDICATES A "FAIR" MATERIAL
- INDEX NO. 15 - 19 INDICATES A "POOR" MATERIAL
- INDEX NO. 20 OR GREATER INDICATES A "VERY POOR" MATERIAL

THE NECESSARY FILL PROPERTIES FOR ZONE B CAN ALSO BE ACHIEVED BY THE USE OF CONTROLLED LOW-STRENGTH MATERIALS (FLOWABLE/SELF-COMPACTING FILL). THIS CAN BE PARTICULARLY BENEFICIAL IN RESTRICTED CONDITIONS (NARROW EXCAVATIONS) WHERE COMPACTING IS DIFFICULT AND/OR WHEN PLACEMENT OF BACKFILL IS TIME-CONSUMING (MULTIPLE-SPAN STRUCTURES). COMPRESSIVE STRENGTHS OF THIS CLSM OF 100 PSI (0.7 N/MM2) OR EVEN LESS ARE APPROPRIATE.

1.3.3 ZONE C

1.3.3.1 ZONE C IS THE ROAD SECTION OF GRAVEL, ASPHALT OR CONCRETE BUILT IN COMPLIANCE WITH LOCAL ENGINEERING PRACTICES. MINIMUM OVERFILL HEIGHT IS ONE FOOT AND A HALF OVER THE CROWN OF THE ARCH, INCLUDING THE PAVEMENT. THERE SHOULD BE AT LEAST 4 INCHES OF SELECT FILL BETWEEN THE ARCH EXTRADOS AND THE BOTTOM OF THE PAVEMENT.

1.3.3.2 PRIOR TO SHIPPING THE PRECAST ARCH ELEMENTS, THE CONTRACTOR SHALL SUPPLY A CERTIFICATION LETTER BY A LICENSED SOILS TESTING FIRM OR REPRESENTATIVE STATING THAT THE BACKFILL SOIL MEETS THE REQUIREMENTS OF SECTION 3.11 B, NUMBER 1 AND 2 ABOVE.

1.4 PLACING AND COMPACTING OF FILL

1.4.1 UNLESS OTHERWISE SPECIFIED, BACKFILLING OPERATIONS SHOULD NOT BEGIN UNTIL THE GROUT OF THE ARCH KEY HAS BEEN IN PLACE FOR 72 HOURS.

1.4.2 DUMPING FOR BACKFILLING IS NOT ALLOWED ANY NEARER THAN 3 FT TO A VERTICAL PLANE THROUGH THE ARCH KEY.

1.4.3 THE FILL MUST BE PLACED AND COMPACTED IN LAYERS NOT EXCEEDING ONE FOOT. THE MAXIMUM DIFFERENCE IN THE SURFACE LEVELS OF THE FILL ON OPPOSITE SIDES OF THE ARCH MUST NOT EXCEED 2 FEET.

1.4.4 THE FILL BEHIND WINGWALLS MUST BE PLACED AT THE SAME TIME AS THAT OF THE ARCH FILL. IT MUST BE PLACED IN PROGRESSIVELY PLACED HORIZONTAL LAYERS NOT EXCEEDING ONE FOOT PER LAYER.

1.4.5 THE BACKFILL OF ZONE B MUST BE COMPACTED TO A MINIMUM DENSITY OF 95 % AS REQUIRED BY AASHTO T-99.

1.4.6 SOIL WITHIN 1 FOOT OF CONCRETE SURFACES SHOULD BE HAND-COMPACTED. ELSEWHERE, USE OF ROLLERS IS ACCEPTABLE. IF VIBRATING ROLLER-COMPACTORS ARE USED, THEY SHOULD NOT BE STARTED OR STOPPED WITHIN ZONE B AND THE VIBRATION FREQUENCY SHOULD BE AT LEAST 30 REVOLUTIONS PER SECOND.

1.4.7 THE BACKFILL MATERIAL AND COMPACTING BEHIND WINGWALLS SHOULD SATISFY THE CRITERIA FOR CONSPAN WINGWALL BACKFILL REQUIREMENTS.

1.5 SETTLEMENTS AND HORIZONTAL DISPLACEMENTS

1.5.1 THE CONTRACTOR SHALL CHECK SETTLEMENTS AND HORIZONTAL DISPLACEMENT OF FOUNDATION TO ENSURE THAT THEY ARE WITHIN THE ALLOWABLE LIMIT PROVIDED BY THE ENGINEER. THESE MEASUREMENTS SHOULD GIVE AN INDICATION OF THE SETTLEMENTS AND DEFORMATIONS ALONG THE LENGTH OF THE FOUNDATIONS.

1.5.2 THE FIRST MEASUREMENT ROW SHOULD TAKE PLACE AFTER THE ERECTION OF ALL PRECAST ARCH SYSTEM ELEMENTS, A SECOND AFTER COMPLETION OF BACKFILLING, AND A THIRD BEFORE OPENING OF THE BRIDGE TO TRAFFIC. FURTHER MEASUREMENTS CAN BE MADE ACCORDING TO LOCAL CONDITIONS.

1.5.3 THE MAXIMUM DIFFERENCE IN VERTICAL DISPLACEMENTS 'V' SHOULD NOT EXCEED 1 INCH ALONG THE LENGTH OF ONE FOUNDATION.

1.5.4 IN CONJUNCTION WITH POSSIBLE DISPLACEMENTS OF THE FOUNDATIONS, CHECK FOR VISIBLE CRACKS IN THE CONCRETE OF THE ARCH INTRA DOS. FINE OR HAIRLINE CRACKS ARE TO BE EXPECTED IN THE CROWN AREA AND ARE NOT HARMFUL.

1.6 MEASUREMENT AND PAYMENT

1.6.1 PAYMENT SHALL BE CONSIDERED FULL COMPENSATION FOR ALL LABOR, MATERIAL, AND EQUIPMENT TO INSTALL THE PRECAST CONCRETE ARCH SYSTEM AND ALL ITS COMPONENTS, FOOTINGS, BACKFILL, ROADWAY AND CLEAN UP.

1.6.2 THE PRECAST CONCRETE ARCH SYSTEM SHALL BE PAID FOR ON A LUMP SUM BASIS.

2 BACKFILL REQUIREMENTS FOR BEBO T SERIES ARCHES

2.1 REQUIRED FILL PROPERTIES

2.1.1 OVERFILL

2.1.1.1 THE OVERFILL AND THE ROAD SECTION OF GRAVEL, ASPHALT OR CONCRETE SHALL BE BUILT IN COMPLIANCE WITH LOCAL ENGINEERING PRACTICES. MINIMUM OVERFILL HEIGHT IS 6 INCHES OVER THE CROWN OF THE ARCH, INCLUDING THE PAVEMENT. THERE SHOULD BE AT LEAST 4 INCHES OF SELECT FILL BETWEEN THE ARCH EXTRADOS AND THE BOTTOM OF THE PAVEMENT.

2.2 PLACING AND COMPACTING OF FILL

2.2.1 UNLESS OTHERWISE SPECIFIED, OVERFILLING OPERATIONS SHOULD NOT BEGIN UNTIL THE CONCRETE OF THE BEBO ARCH FOOTINGS AND THE GROUT AROUND THE TRANSVERSE DOWEL RODS HAVE BEEN IN PLACE FOR 72 HOURS.

2.2.2 DUMPING FOR BACKFILLING IS NOT ALLOWED ANY NEARER THAN 3 FT TO A VERTICAL PLANE THROUGH THE ARCH SPRING.

2.2.3 THE FILL MUST BE PLACED AND COMPACTED IN LAYERS NOT EXCEEDING ONE FOOT. THE MAXIMUM DIFFERENCE IN THE SURFACE LEVELS OF THE FILL ON OPPOSITE SIDES OF THE ARCH MUST NOT EXCEED 2 FEET. LINES ARE PAINTED AND NUMBERED ON ARCH ELEMENTS TO INDICATE EACH BACKFILL LEVEL. THIS SERVES AS A GUIDE FOR EQUIPMENT OPERATORS AND HELPS TO ENSURE THAT THE MAXIMUM DIFFERENCE IS NOT EXCEEDED.

2.2.4 THE FILL BEHIND WINGWALLS MUST BE PLACED AT THE SAME TIME AS THAT OF THE ARCH FILL. IT MUST BE PLACED IN PROGRESSIVELY PLACED HORIZONTAL LAYERS NOT EXCEEDING ONE FOOT PER LAYER AND SHALL MEET THE SPECIFICATIONS UNDER ATTACHMENT A HEREIN.

2.2.5 THE OVERFILL MUST BE COMPACTED TO A MINIMUM DENSITY OF 95 % AS REQUIRED BY AASHTO T-99.

2.2.6 SOIL WITHIN 1 FOOT OF CONCRETE SURFACES SHOULD BE HAND-COMPACTED. ELSEWHERE, USE OF ROLLERS IS ACCEPTABLE. IF VIBRATING ROLLER-COMPACTORS ARE USED, THEY SHOULD NOT BE STARTED OR STOPPED WITHIN 3 FT TO A VERTICAL PLANE THROUGH THE ARCH SPRINGS AND THE VIBRATION FREQUENCY SHOULD BE AT LEAST 30 REVOLUTIONS PER SECOND.

2.2.7 THERE ARE NO SPECIAL REQUIREMENTS FOR THE BACKFILL MATERIAL AND COMPACTING BEHIND WINGWALLS EXCEPT THAT EACH SHOULD SATISFY THE CRITERIA FOR NORMAL ROAD EMBANKMENTS.

2.3 SETTLEMENTS AND HORIZONTAL DISPLACEMENTS

2.3.1 THE CONTRACTOR SHALL CHECK SETTLEMENTS AND HORIZONTAL DISPLACEMENT OF FOUNDATION TO ENSURE THAT THEY ARE WITHIN THE ALLOWABLE LIMIT PROVIDED BY THE ENGINEER. THESE MEASUREMENTS SHOULD GIVE AN INDICATION OF THE SETTLEMENTS AND DEFORMATIONS ALONG THE LENGTH OF THE FOUNDATIONS.

2.3.2 THE FIRST MEASUREMENT ROW SHOULD TAKE PLACE AFTER THE ERECTION OF ALL BEBO PRECAST ARCH SYSTEM ELEMENTS, A SECOND AFTER COMPLETION OF BACKFILLING, AND A THIRD BEFORE OPENING OF THE BRIDGE TO TRAFFIC. FURTHER MEASUREMENTS CAN BE MADE ACCORDING TO LOCAL CONDITIONS.

2.3.3 THE MAXIMUM DIFFERENCE IN VERTICAL DISPLACEMENTS 'V' SHOULD NOT EXCEED 1 INCH ALONG THE LENGTH OF ONE FOUNDATION.

2.3.4 IN CONJUNCTION WITH POSSIBLE DISPLACEMENTS OF THE FOUNDATIONS, CHECK FOR VISIBLE CRACKS IN THE CONCRETE OF THE ARCH INTRADOS. FINE OR HAIRLINE CRACK S ARE TO BE EXPECTED IN THE CROWN AREA AND ARE NOT HARMFUL.

2.4 MEASUREMENT AND PAYMENT

2.4.1 PAYMENT SHALL BE CONSIDERED FULL COMPENSATION FOR ALL LABOR, MATERIAL, AND EQUIPMENT TO INSTALL THE BEBO ARCH SYSTEM AND ALL ITS COMPONENTS, FOOTINGS, ABUTMENTS, BACKFILL, ROADWAY AND CLEAN UP.

2.4.2 THE BEBO-TOP PRECAST ARCH OVERFILLED SYSTEM SHALL BE PAID FOR ON A LUMP SUM BASIS.

BEBO® Arch Systems

CONTECH BRIDGE SOLUTIONS
3100 RESEARCH BLVD.
DAYTON, OH 45420
TEL: 800.526.3999
FAX: 937.254.8365

ENGINEER'S SEAL

NO	DATE:	BY:	
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1	8/8/06	JJV	GENERAL REVISIONS

STANDARD DRAWINGS

KY TRANSPORTATION CABINET

BACKFILL SPECIFICATIONS

JOB NO:

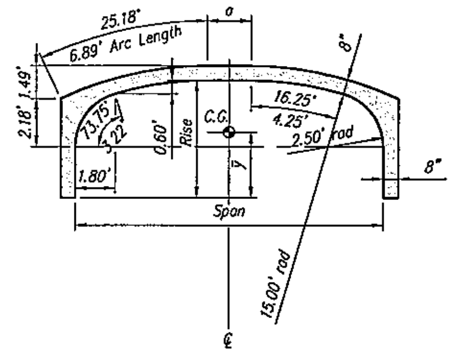
SHORT SPAN SERIES

MAXIMUM UNIT LENGTH = 8'-0"

CULVERT DIMENSIONS		
SPAN	12'	14'
a	0.00'	2.00'

WATERWAY AREA (Square Feet)		
RISE (ft)	SPAN	
	12'	14'
4	42	50
5	54	64
6	66	78
7	78	92
8	90	106
9	102	120
10	114	134
11		148

Minimum Cover = 0'
Maximum Cover = 50' *



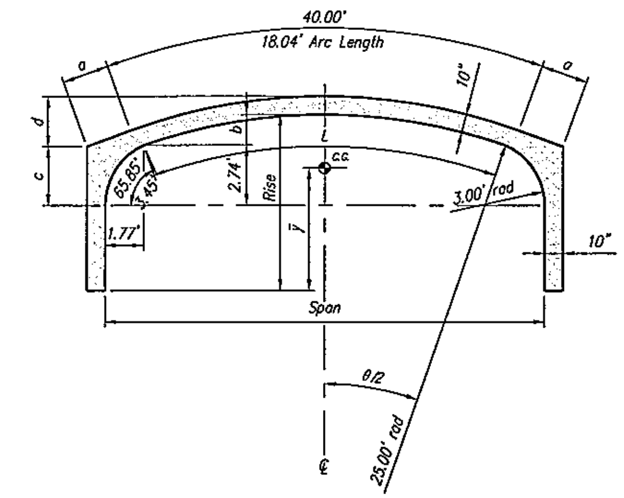
MID-SPAN SERIES

MAXIMUM UNIT LENGTH = 8'-0"

CULVERT DIMENSIONS			
SPAN	16'	20'	24'
θ	28.85°	38.43°	48.29°
L	12.59'	16.77'	21.07'
a	0.00'	2.13'	4.26'
b	0.79'	1.39'	2.19'
c	2.80'	2.68'	2.75'
d	1.56'	2.29'	3.01'

WATERWAY AREA (Square Feet)			
RISE (ft)	SPAN		
	16'	20'	24'
5	71	85	
6	87	105	119
7	103	125	143
8	119	145	167
9	135	165	191
10	151	185	215

Minimum Cover = 0'
Maximum Cover = 30' *



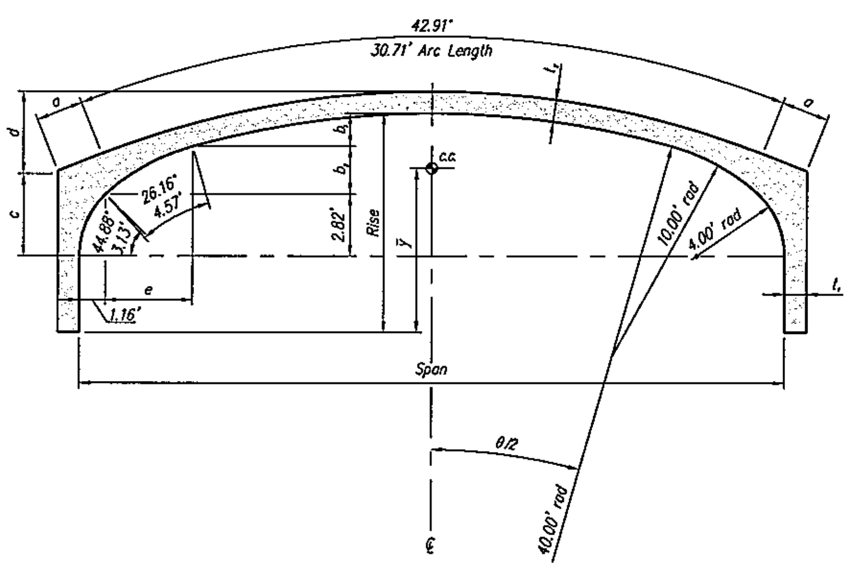
LONG SPAN SERIES

MAXIMUM UNIT LENGTH = 6'-0"

CULVERT DIMENSIONS			
SPAN	28'	32'	36'
θ	25.30°	31.54°	37.93°
L	17.66'	22.02'	26.48'
a	0.00'	2.15'	4.48'
b_1	0.97'	1.51'	2.17'
b_2	1.96'	2.18'	2.40'
c	3.76'	3.88'	3.91'
d	2.84'	3.63'	4.48'
e	4.07'	3.96'	3.83'
t_1	12"	12"	14"
t_2	10"@ ℄	12"	12"

WATERWAY AREA (Square Feet)			
RISE (ft)	SPAN		
	28'	32'	36'
8	195	216	
9	223	248	268
10	251	280	304
11	279	312	340
12		344	376
13			412

Minimum Cover = 0'
Maximum Cover = 20' *

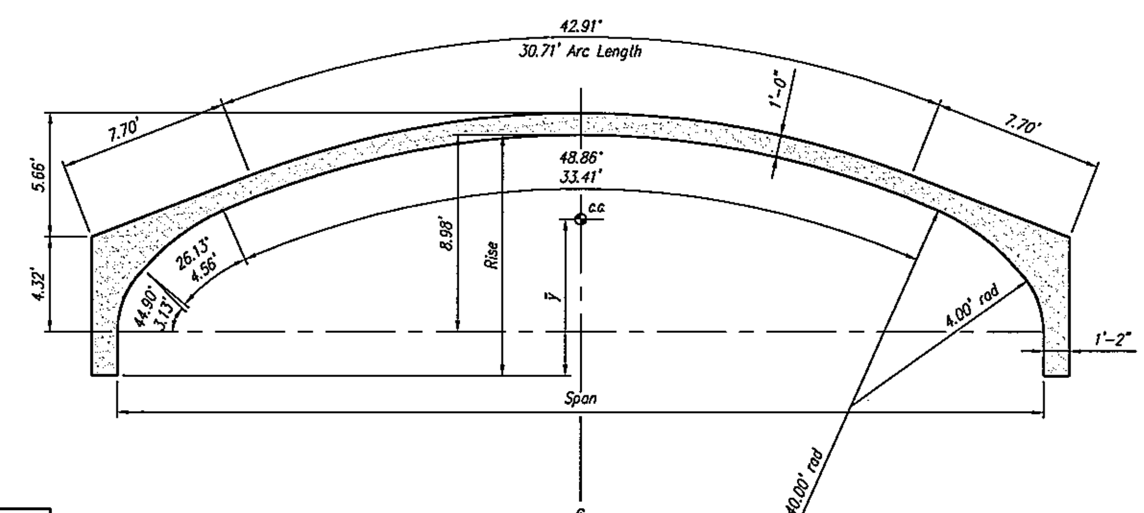


MODIFIED LONG SPAN SERIES

MAXIMUM UNIT LENGTH = 6'-0"

WATERWAY AREA (Square Feet)	
RISE (ft)	SPAN
	42' "EC"
10	334
11	376
12	418
13	460
14	502

Minimum Cover = 0'
Maximum Cover = 15' *



*Note: Special designs are available if additional cover is required.

No.	Date
1	8/8/06
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REVISIONS

Provided Locally by:
CONTECH
BRIDGE SOLUTIONS INC.
KENTUCKY
502-493-2930

CON/SPAN® BRIDGE SYSTEMS

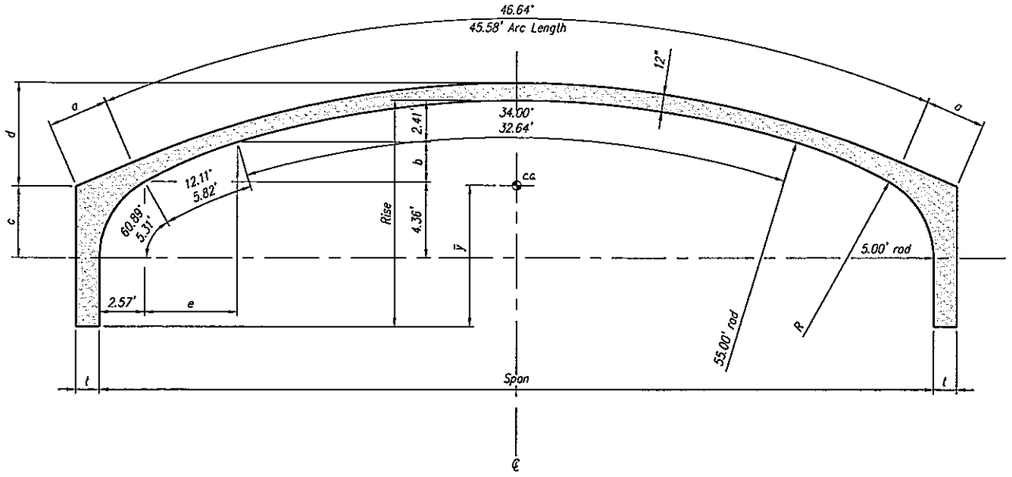
KY TRANSPORTATION CABINET
STANDARD DRAWINGS
CON/SPAN GEOMETRY

Designed	ZDW	C/S Project No.	
Drawn	ZDW		
Checked	JJV	Sheet No.	1/7
Date	2/2/06		

CULVERT DIMENSIONS	
SPAN	48'
R	27.573'
a	3.45'
b	2.281'
c	4.115'
d	5.938'
e	5.354'
t	16"

WATERWAY AREA (Square Feet)	
RISE (ft)	SPAN 48'
11	435
12	483

Minimum Cover = 0'
Maximum Cover = 10' *



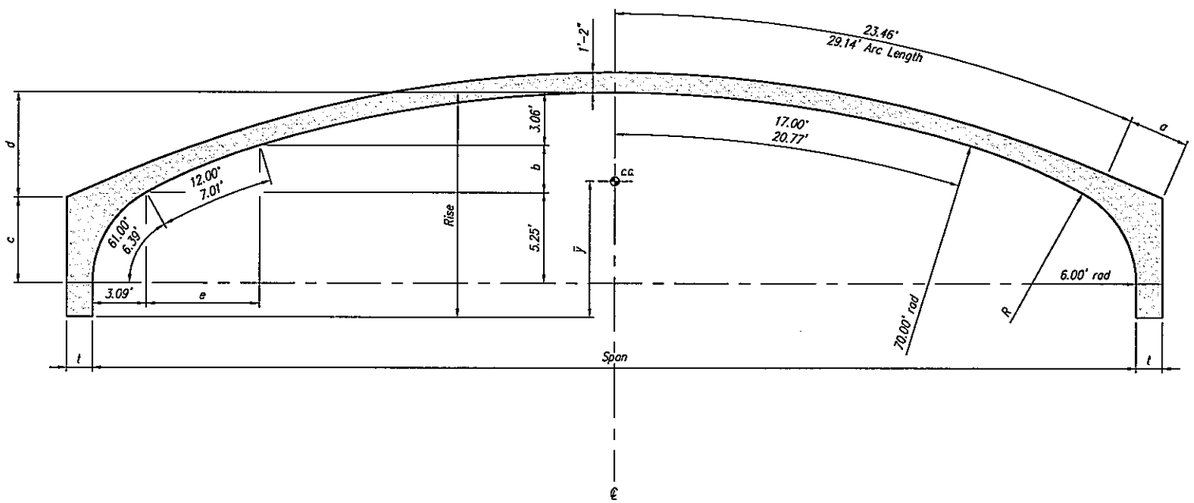
EXTENDED SPAN SERIES

MAXIMUM UNIT LENGTH = 4'-0"

CULVERT DIMENSIONS		
SPAN	54'	60'
R	17.891'	33.479'
a	0.0'	3.45'
b	1.464'	2.734'
c	5.052'	4.948'
d	4.719'	6.089'
e	3.443'	6.443'
t	16"	18"

WATERWAY AREA (Square Feet)		
RISE (ft)	SPAN 54'	60'
10	436	
11	490	
12	544	578
13	598	638
14	652	698

Minimum Cover = 0'
Maximum Cover = 10' *



MEGA SPAN SERIES

MAXIMUM UNIT LENGTH = 3'-6"

*Note: Special designs are available if additional cover is required.

No.	Date	REVISIONS
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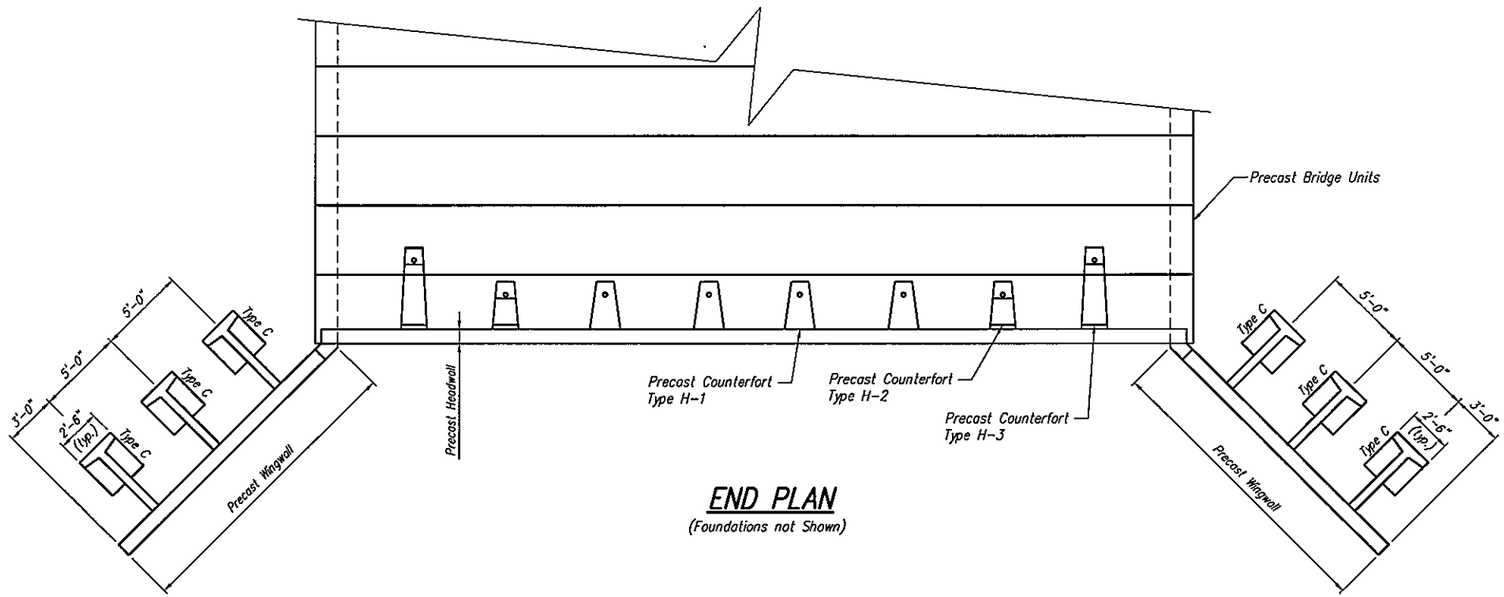
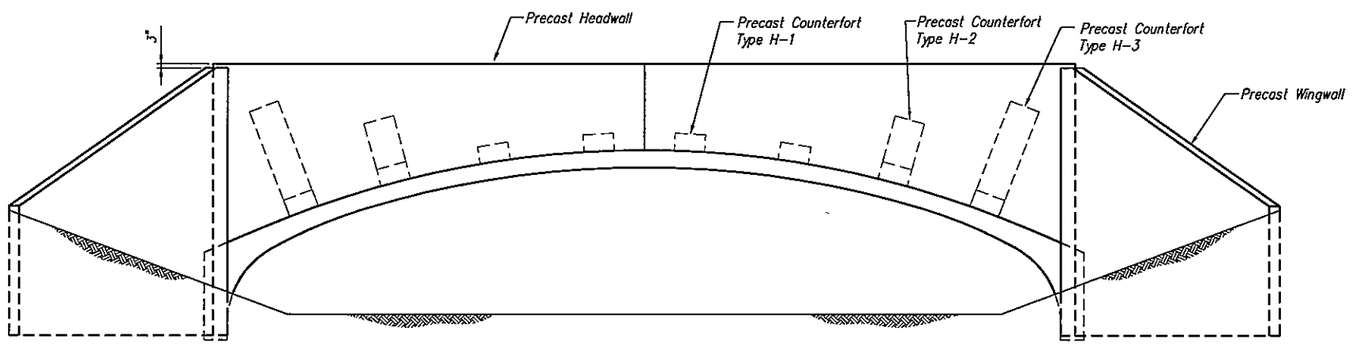
CON/SPAN® BRIDGE SYSTEMS

KY TRANSPORTATION CABINET
STANDARD DRAWINGS
CON/SPAN GEOMETRY

Designed	ZDW	OS Project No.	
Drawn	ZDW		
Checked	JJV	Sheet No.	2/7
Date	2/2/06		



END PLAN
(Foundations not Shown)



END ELEVATION
(Foundations not Shown)

No.	Date	REVISIONS
1	8/8/06	
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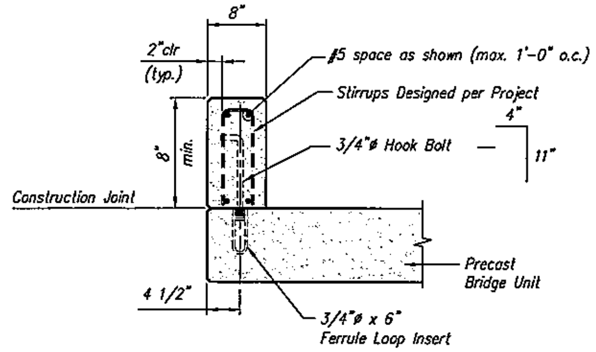
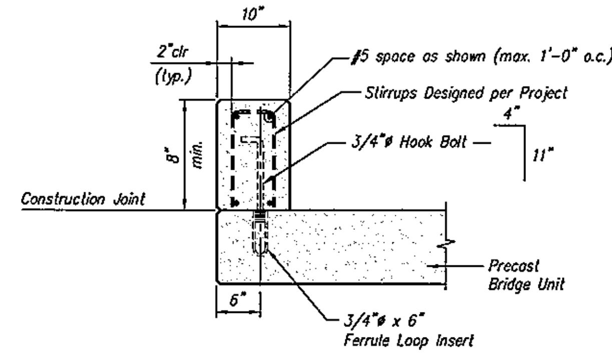
CONSPAN® BRIDGE SYSTEMS

KY TRANSPORTATION CABINET
STANDARD DRAWINGS
STANDARD END TREATMENTS

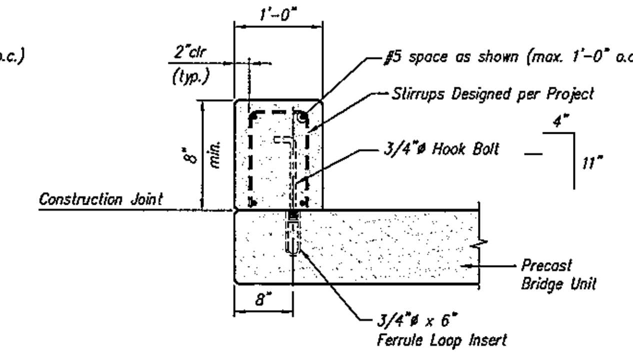
Designed	ZDW	CS Project No.	
Drawn	ZDW		
Checked	JJV	Sheet No.	3/7
Date	2/2/06		



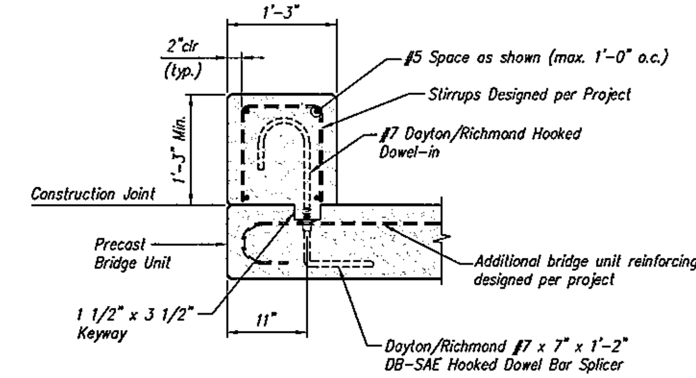
8" ATTACHED HEADWALL



10" ATTACHED HEADWALL



12" ATTACHED HEADWALL

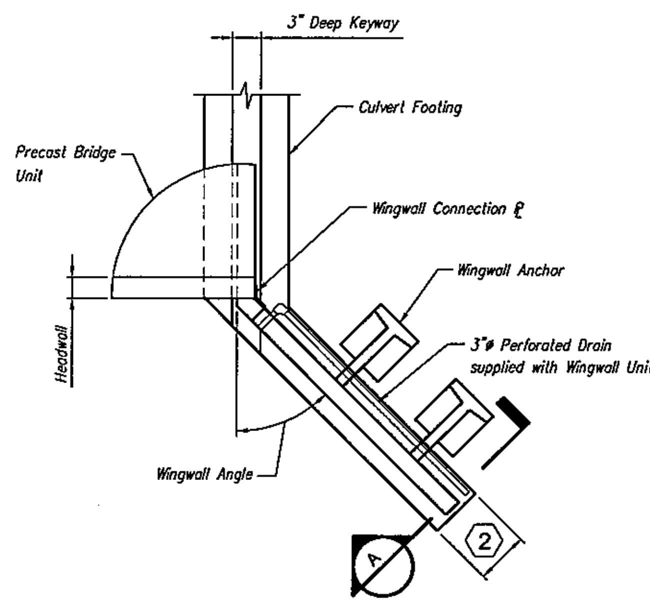


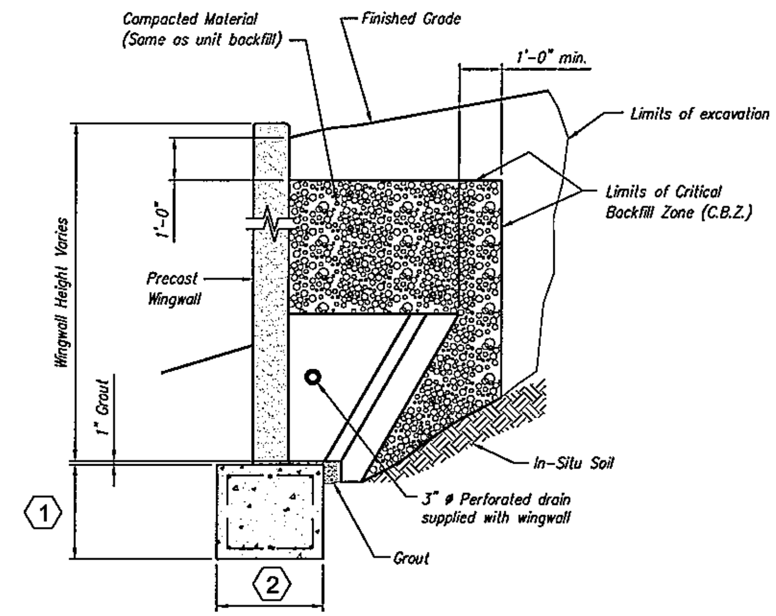
15" ATTACHED HEADWALL FOR GUIDERAIL

PRECAST WINGWALL DETAILS

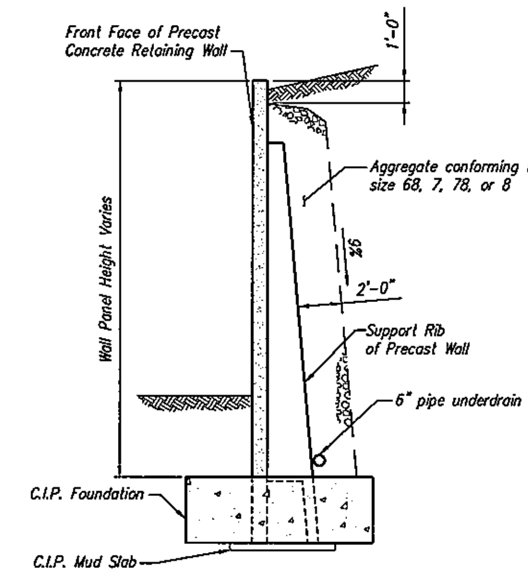
NOTES:

1. Footing depth determined by scour considerations.
2. Wingwall footing width determined by allowable soil bearing.
3. For level installation, top of culvert and wingwall footings at same elevation. For sloping installation, top of footings to be on same plane.
4. Provide bent bars to make culvert and wingwall footing reinforcing continuous.

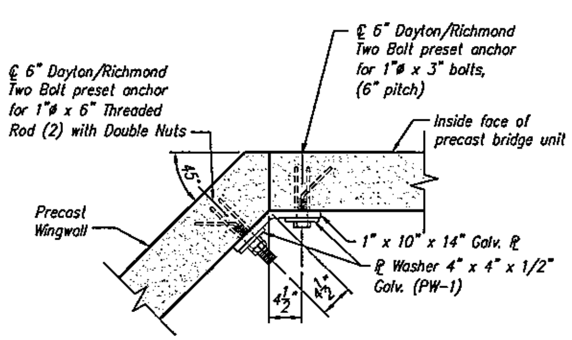




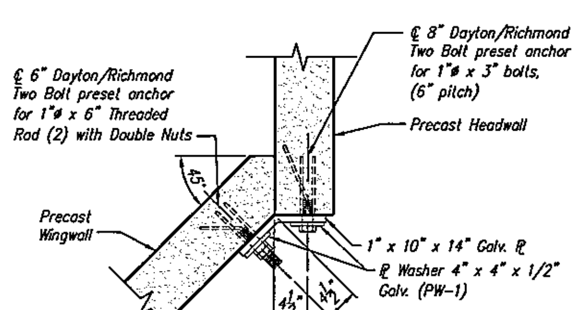
SECTION A



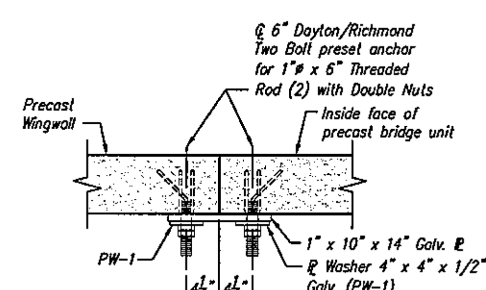
PRECAST MUR EBAL WALL PANEL



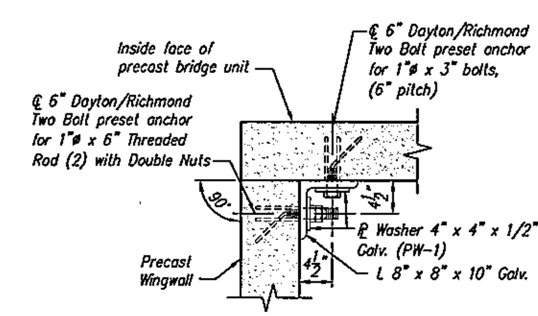
45° WINGWALL CONNECTION PLATE DETAIL @ UNIT LEG



45° WINGWALL CONNECTION PLATE DETAIL @ HEADWALL



0° WINGWALL CONNECTION PLATE DETAIL @ UNIT LEG



90° WINGWALL CONNECTION PLATE DETAIL @ UNIT LEG

Note: Standard wingwall angles are 0, 30, 45, 60, and 90 degrees. Special angles may be fabricated to meet specific site requirements.

No.	Date
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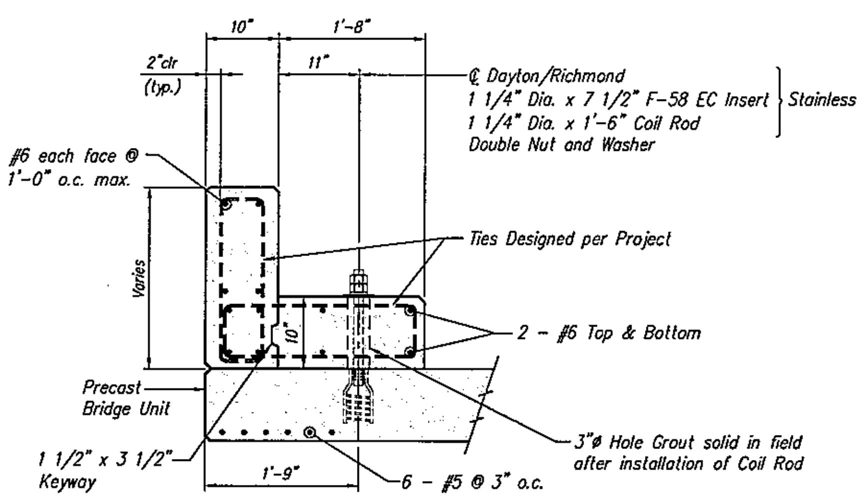
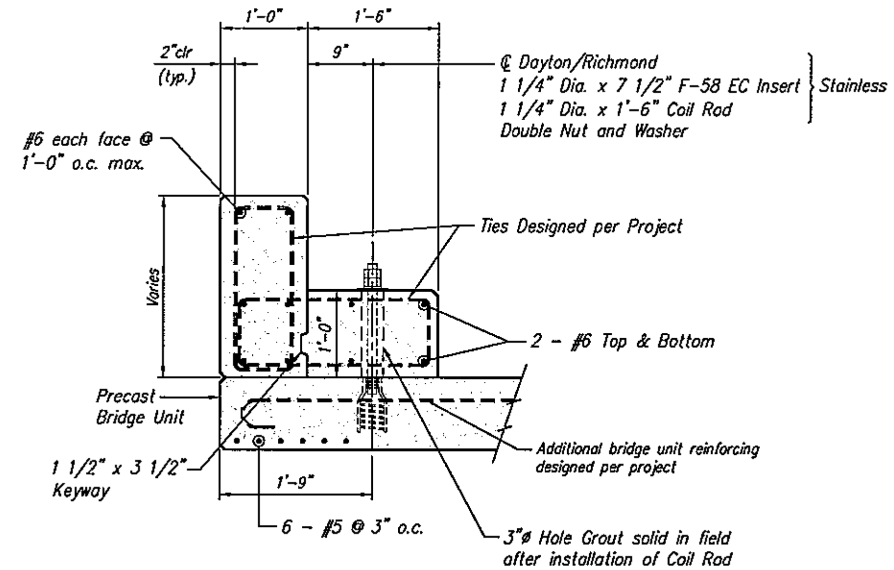
CON/SPAN® BRIDGE SYSTEMS

KY TRANSPORTATION CABINET
STANDARD DRAWINGS
HEADWALL & WIGNWALL DETAILS

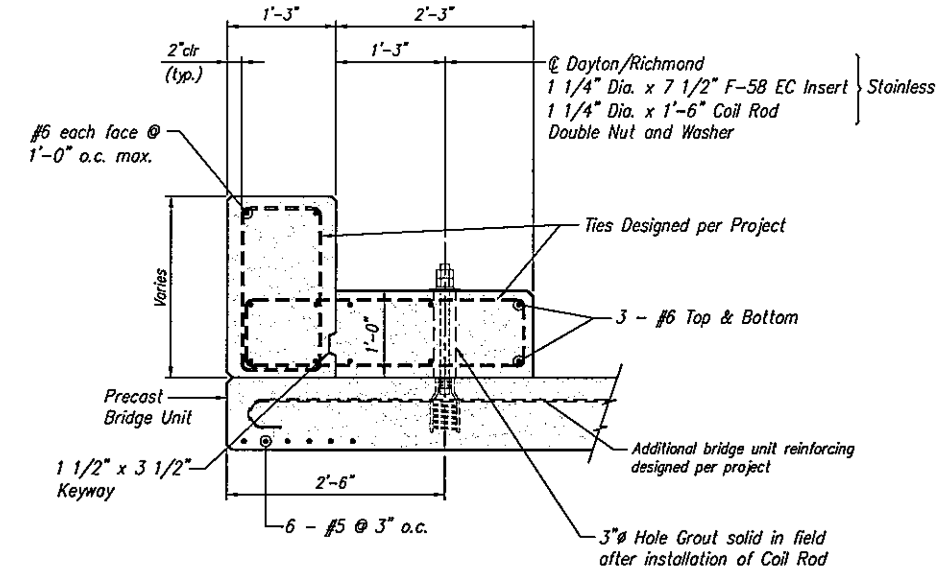
Designed	ZDW	C/S Project No.	
Drawn	ZDW		
Checked	JJV	Sheet No.	4/7
Date	2/2/06		



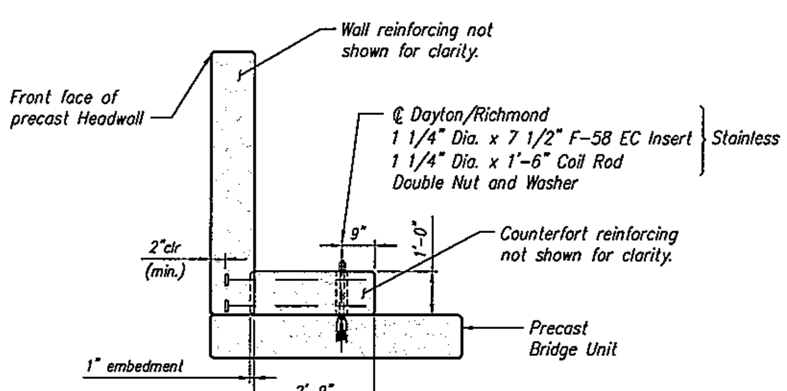
10" DETACHED HEADWALL CONTINUOUS COLLAR



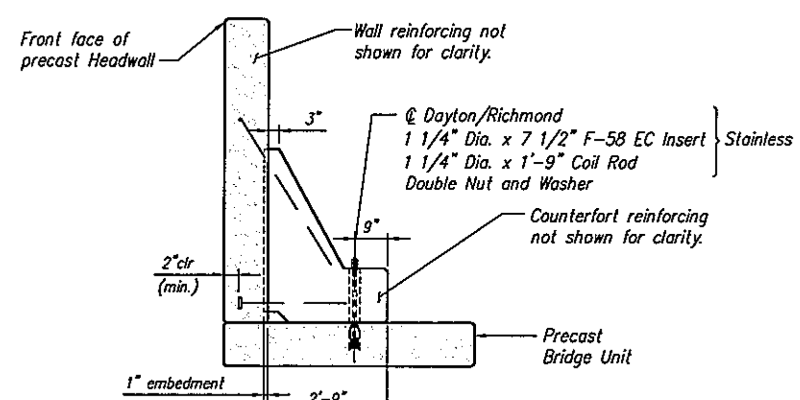
12" DETACHED HEADWALL CONTINUOUS COLLAR



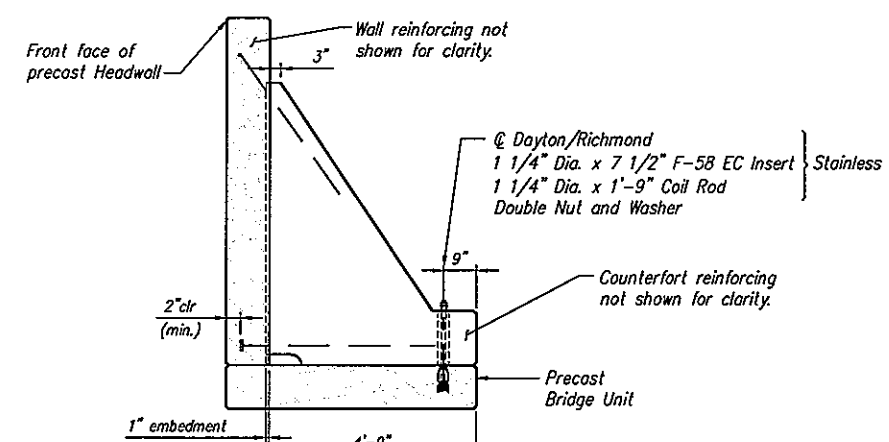
15" DETACHED HEADWALL CONTINUOUS COLLAR – FOR GUIDERAIL



DETACHED HEADWALL COUNTERFORT TYPE H-1



DETACHED HEADWALL COUNTERFORT TYPE H-2



DETACHED HEADWALL COUNTERFORT TYPE H-3

No.	Date
1	8/8/06
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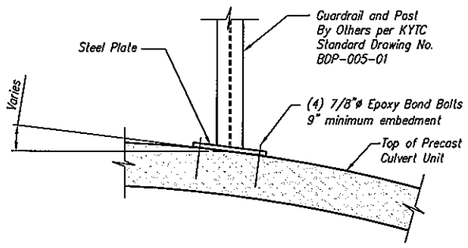
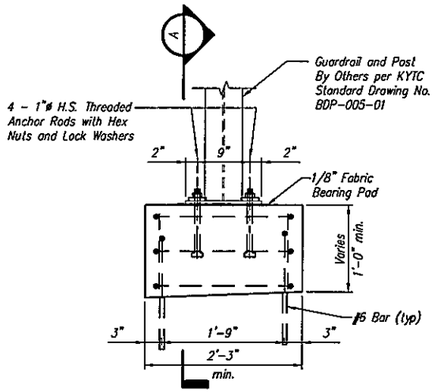
CON/SPAN® BRIDGE SYSTEMS

KY TRANSPORTATION CABINET STANDARD DRAWINGS DETACHED HEADWALL DETAILS

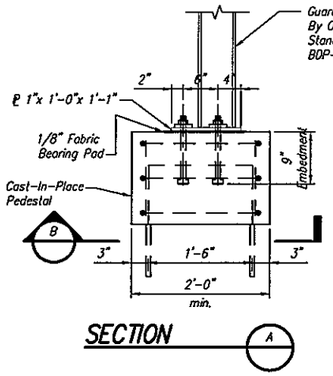
Designed	ZDW	C/S Project No.	
Drawn	ZDW		
Checked	JJV	Sheet No.	
Date	2/2/06		5/7



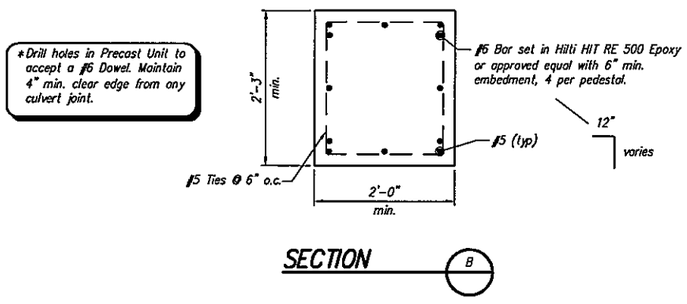
OPTION 1 – POST ATTACHMENT TO BRIDGE UNIT



PEDESTAL DETAIL

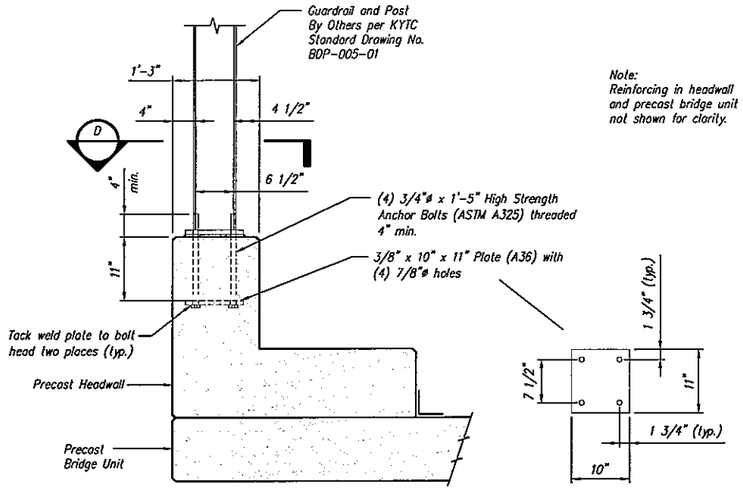


SECTION A

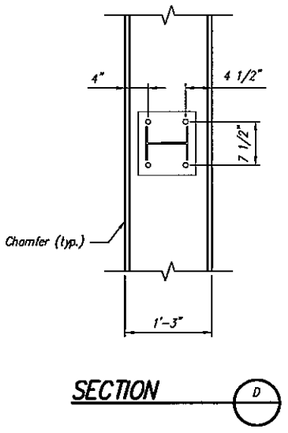


SECTION B

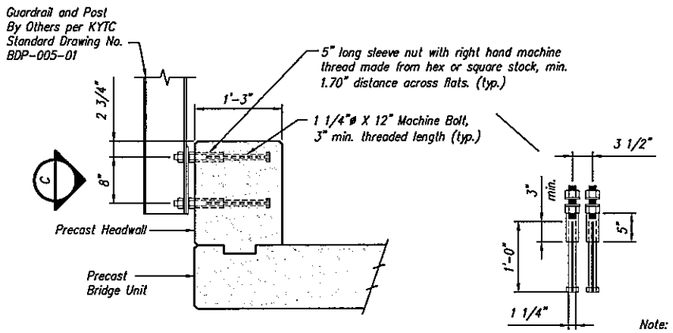
OPTION 2 – POST ATTACHMENT TO CAST-IN-PLACE PEDESTAL



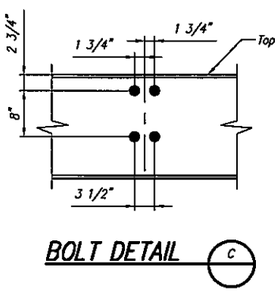
TOP MOUNTED GUARDRAIL CONNECTION



SECTION D



SIDE MOUNTED GUARDRAIL CONNECTION



BOLT DETAIL C

No.	Date	REVISIONS
1	8/8/06	
2		
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5		
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KENTUCKY
502-493-2830

CONSPAN® BRIDGE SYSTEMS

KY TRANSPORTATION CABINET
STANDARD DRAWINGS
GUIDERAIL POST ATTACHMENT TO BRIDGE UNIT

Designed	ZDW	CS Project No.	
Drawn	ZDW		
Checked	JJV	Sheet No.	6/7
Date	2/2/06		

PRECAST REQUIREMENTS

1 All materials must be in conformance with KYTC Standard Specifications for Road and Bridge Construction, the KYTC List of Approved Materials, and all applicable ASTM and AASHTO standards.

2 All precast components shall be manufactured by a fabricator approved by KYTC and be in strict compliance with Section 605 of the Kentucky Transportation Cabinet, Department of Highways, Standard Specifications for Road and Bridge Construction.

3 Comply with Section 106.4 of the Standard Specifications for Road and Bridge Construction Buy American Requirement.

4 Precast arch units shall be constructed with one weephole in each leg per KYTC Standard Specifications for Road and Bridge Construction.

5 Precast components shall be designed according to the current version of the AASHTO LRFD Bridge Design Specifications. Arch units shall be designed to support HL-93 Live Load.

CONSTRUCTION REQUIREMENTS

1 Footings - The bridge units and wingwalls shall be installed on either precast or cast-in-place concrete footings. The design size and elevation of the footings shall be as specified on the plans. A three inch deep keyway shall be formed in the top surface of the bridge footing three inches clear of the inside and outside faces of the bridge units, unless specified otherwise on the plans. No keyway is required in the wingwall footings, unless otherwise specified on the plans. The footings shall be given a smooth float finish and shall reach a compressive strength of 2,000 psi before placement of the bridge and wingwall elements. The completed footing surface shall be constructed in accordance with grades shown on the plans. When tested with a 10 foot straight edge, the surface shall not vary more than 1/4 inch in 10 feet. If a precast concrete footing is used, the contractor shall prepare a 4 inch thick base layer of compacted granular material the full width of the footing prior to placing the precast footing.

2 Placement of the Bridge Units, Wingwalls and Headwalls - The bridge units, wingwalls and headwalls shall be placed as shown on the Engineer's plan drawings. Special care shall be taken in setting the elements to the true line and grade. The bridge units and wingwalls shall be set on masonite or steel shims. A minimum gap of 1/2 inch shall be provided between the footing and the bottom of the bridge's vertical legs or the wingwall. The gap shall be filled with non-shrink cement grout with a minimum 28-day compressive strength of 3000 psi. If units have been set with temporary ties (cables, bars, etc.) grout must attain a minimum compressive strength of 1500 psi before ties may be removed.

3 External Protection of Joints - The butt joint made by two adjoining bridge units shall be covered with a 7/8" x 1 3/8" preformed bituminous joint sealant and a minimum of a 9 inch wide joint wrap. The surface shall be free of dirt before applying the joint material. A primer compatible with the joint wrap to be used shall be applied for a minimum width of nine inches on each side of the joint. The external wrap shall be either EZ-WRAP RUBBER by PRESS-SEAL GASKET CORPORATION, SEAL WRAP by MAR MAC MANUFACTURING CO. INC. or approved equal. The joint shall be covered continuously from the bottom of one bridge section leg, across the top of the arch and to the opposite bridge section leg. Any laps that result in the joint wrap shall be a minimum of six inches long with the overlap running downhill.

In addition to the joints between bridge units, the joint between the end bridge unit and the headwall shall also be sealed as described above. If precast wingwalls are used, the joint between the end bridge unit and the wingwall shall be sealed with a 2'-0" strip of filter fabric. Also, if lift holes are formed in the arch units, they shall be primed and covered with a 9" x 9" square of joint wrap.

During the backfilling operation, care shall be taken to keep the joint wrap in its proper location over the joint.

4 Backfill - Backfill shall be considered as all replaced excavation and new embankment adjacent to the precast bridge units, wingwalls, and headwalls. The project construction and material specifications which include the specifications for excavation for structures and roadway excavation and embankment construction, shall apply except as modified in this section.

No backfill shall be placed against any structural elements until they have been approved by the Engineer.

Backfill against a waterproofed surface shall be placed carefully to avoid damage to the waterproofing material.

Mechanical tampers or approved compacting equipment shall be used to compact all backfill and embankment immediately adjacent to each side and over the top of each bridge unit until it is covered to a minimum depth of one foot, unless the design fill height is less than 1'-0". The backfill within the Critical Backfill Zone (shown in the diagrams below) shall be placed in lifts of eight inches or less (loose depth). Heavy compaction equipment shall not be operated in this area or over the bridge until it is covered to a depth of one foot, unless the design fill height is less than 1'-0".

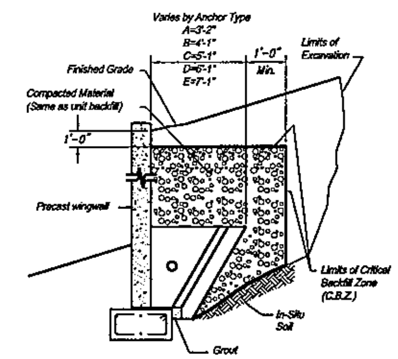
Lightweight dozers and graders may be operated over bridge units having one foot of compacted cover, but heavy earth moving equipment (larger than a D-4 Dozer weighing in excess of 12 tons and having track pressures of eight psi or greater) shall require two feet of cover unless the design cover is less than two feet. In no case shall equipment operating in excess of the design load (HS20 or HS25) be permitted over the bridge units unless approved by the precast designer.

Any additional fill and subsequent excavation required to provide this minimum cover shall be made at no additional cost to the project.

As a precaution against introducing unbalanced stresses in the bridge, when placing backfill at no time shall the difference between the heights of fill on opposite sides of the bridge exceed 24".

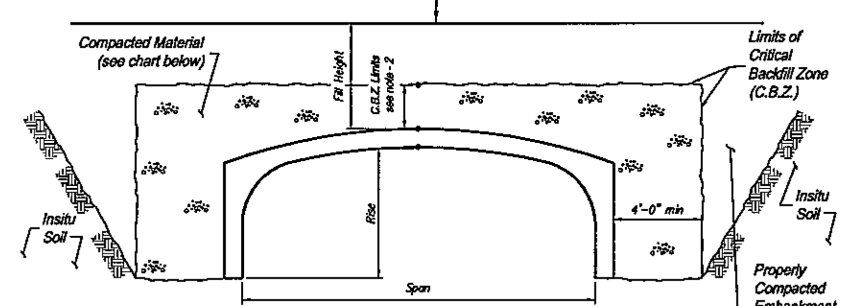
Backfill in front of wingwalls shall be carried to ground lines shown in the plans.

No backfilling may begin until a backfill compaction testing plan has been coordinated with and approved by the precast provider. Cost of the backfill compaction testing shall be included in the cost of the precast units.



WINGWALL BACKFILL REQUIREMENTS

BACKFILL DESCRIPTION (AASHTO M 145-91)								
Group Classification	A-1		A-3	A-2				A-4
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7	
Sieve Analysis, Percent Passing (100% Passing 3" Sieve)								
No. 10	50 max.							
No. 40	30 max.	50 max.	51 min.					
No. 200	15 max.	25 max.	10 max.	35 max.	35 max.	35 max.	35 max.	36 min.
Characteristics of Fraction Passing								
No. 40								
Liquid Limit				40 max.	41 min.	40 max.	41 min.	40 max.
Plasticity Index	6 max.		N.P.	10 max.	10 max.	11 min.	11 min.	10 max.
Usual Types of Significant Constituent Materials	Stone Fragments, Gravel & Sand		Fine Sand	Silty or Clayey Gravel and Sand				Silty Soils
General Rating as Subgrade	Excellent to Good							Fair to Poor



ELEVATION

NOTES
1. SEE ITEM 4 FOR BACKFILL SPECIFICATIONS.
2. FOR FILL HEIGHTS GREATER THAN 2'-0", C.B.Z. LIMIT SHALL BE 2'-0" ABOVE ARCH CROWN. FOR FILL HEIGHTS LESS THAN 2'-0", THE FINISHED GRADE SHALL BE THE BOUNDARY LINE FOR THE C.B.Z.
3. BACKFILLING OPERATIONS WITHIN THE C.B.Z. SHALL BE PERFORMED IN LIFTS OF 8" OR LESS (LOOSE DEPTH).
4. MAXIMUM DENSITY SHALL BE DETERMINED BY KM 64-511 OR OTHER APPROVED METHODS.
5. BACKFILL SHALL BE COMPACTED IN LAYERS UNTIL THE DENSITY IS NOT LESS THAN 95 % OF THE MAXIMUM DENSITY.

SPAN	FILL HEIGHT	ACCEPTABLE MATERIAL INSIDE C.B.Z.	ACCEPTABLE MATERIAL OUTSIDE C.B.Z.
≤ 24'-0"	≥ 12'-0"	A1, A3	**
≤ 24'-0"	< 12'-0"	A1, A2, A3, A4	**
> 24'-0"	ALL	A1, A3	**

** EMBANKMENT MATERIAL PER KYTC SPECIFICATIONS

BACKFILL REQUIREMENTS

No.	Date
1	8/8/06
2	
3	
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CON/SPAN® BRIDGE SYSTEMS

KY TRANSPORTATION CABINET STANDARD DRAWINGS GUIDETAIL DETAILS AND BACKFILL SPACIFICATIONS

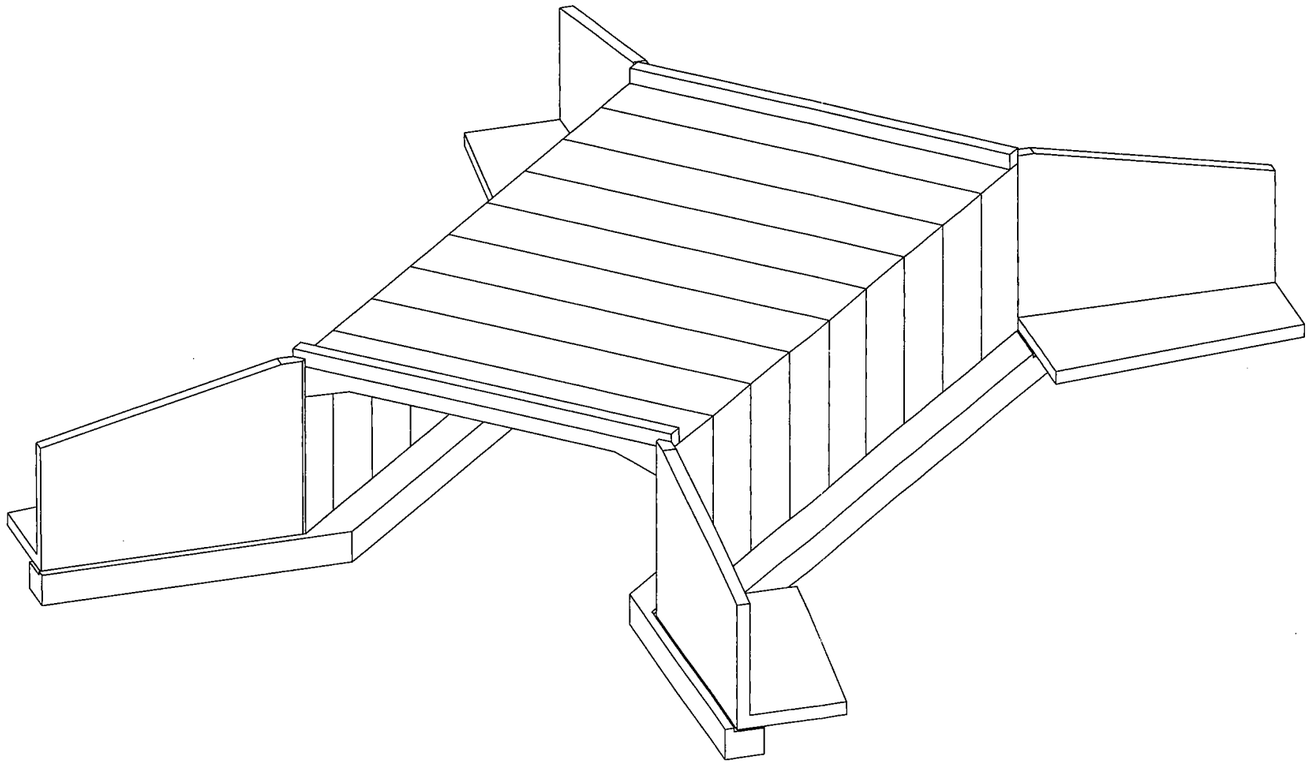
Designed	ZDW	C/S Project No.	
Drawn	ZDW		
Checked	JJV	Sheet No.	7/7
Date	2/2/06		

INDEX	
1	TITLE SHEET
2	BRIDGE DETAILS
3	FOOTING AND JOINT DETAILS
4	HEADWALL AND WINGWALL DETAILS
5	GENERAL NOTES AND SPECIFICATIONS

/ HY-SPAN®

The Instant Bridge™

GUIDELINES FOR HY-SPAN BRIDGE SYSTEMS
PREPARED FOR
KENTUCKY TRANSPORTATION CABINET



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Sym.	Revisions	Date

Designed: SJC
Drawn: AJE/MAM
Checked: SJC
Scale: As Noted
Date: 7/13/06

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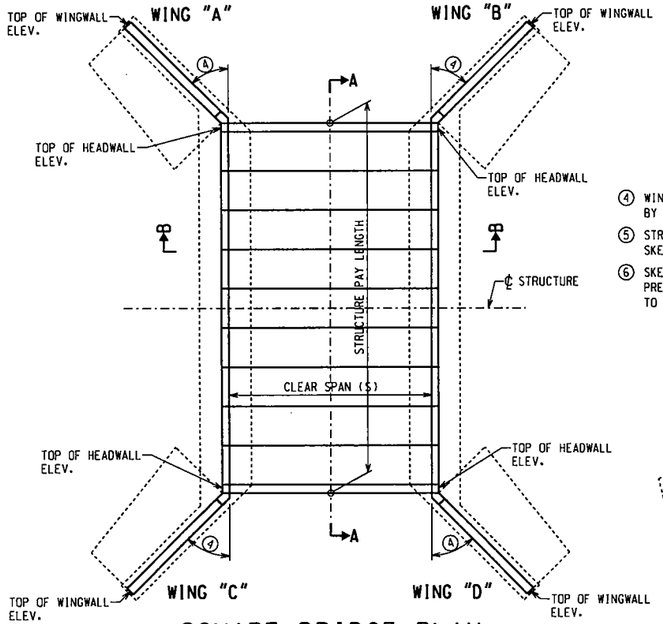
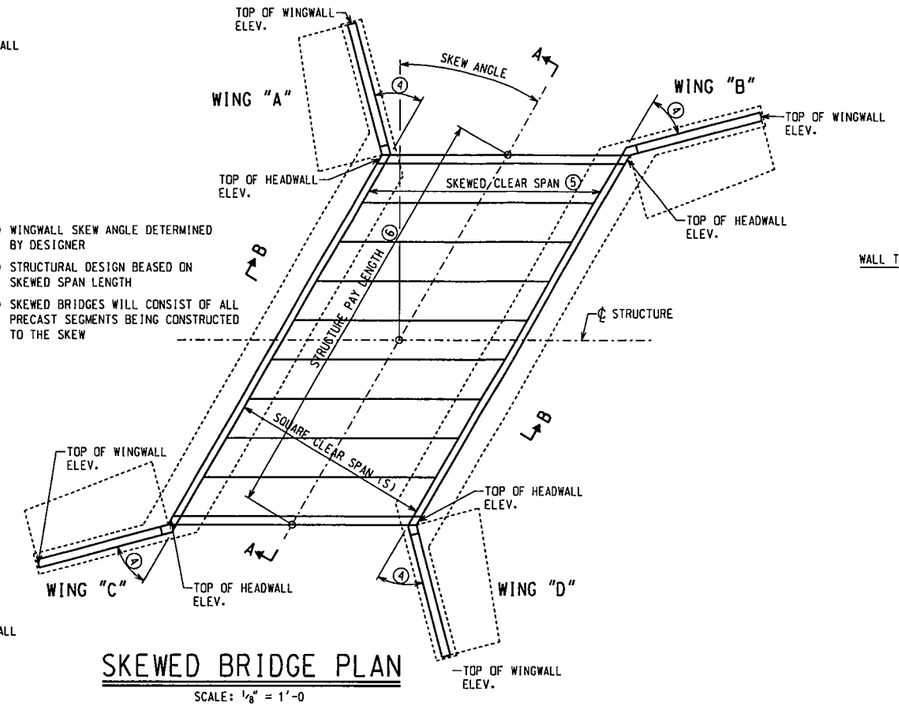
Project No:

Sheet No: 1 of 5



SQUARE BRIDGE PLAN

SCALE: 1/8" = 1'-0



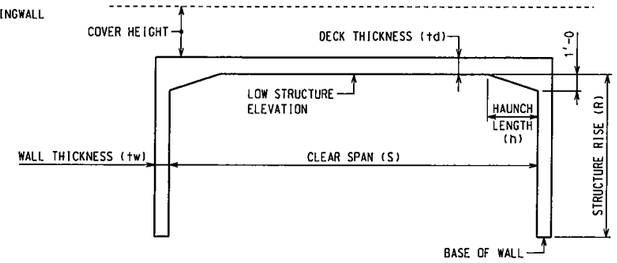
④ WINGWALL SKEW ANGLE DETERMINED BY DESIGNER

⑤ STRUCTURAL DESIGN BEASED ON SKEWED SPAN LENGTH

⑥ SKEWED BRIDGES WILL CONSIST OF ALL PRECAST SEGMENTS BEING CONSTRUCTED TO THE SKEW

SKEWED BRIDGE PLAN

SCALE: 1/8" = 1'-0

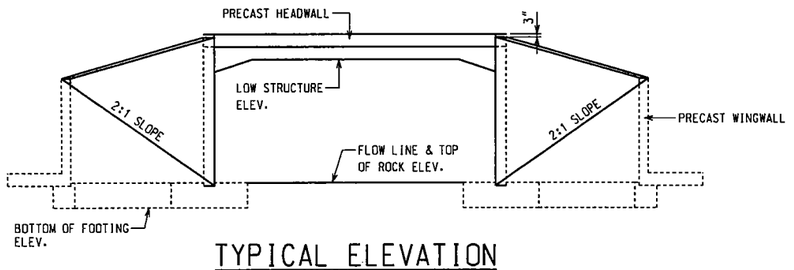


S ① (FT)	R ① (FT)	td (IN)	tw (IN)	h (FT)	MAXIMUM ② COVER HEIGHT	WATERWAY ③ OPENING
14	4	12	10	3	15'-0	53.0
14	6	12	10	3	15'-0	81.0
14	8	12	10	3	15'-0	109.0
14	10	12	10	3	15'-0	137.0
16	4	12	10	3	15'-0	61.0
16	6	12	10	3	15'-0	93.0
16	8	12	10	3	15'-0	125.0
16	10	12	10	3	15'-0	157.0
18	4	12	10	3	15'-0	69.0
18	6	12	10	3	15'-0	105.0
18	8	12	10	3	15'-0	141.0
18	10	12	10	3	15'-0	177.0
20	4	12	10	3	15'-0	77.0
20	6	12	10	3	15'-0	117.0
20	8	12	10	3	15'-0	157.0
20	10	12	10	3	15'-0	197.0
22	4	12	11	3	8'-0	85.0
22	6	12	10	3	8'-0	129.0
22	8	12	10	3	8'-0	173.0
22	10	12	10	3	8'-0	217.0
24	4	12	12	6.67	8'-0	89.3
24	6	12	12	6.67	8'-0	137.3
24	8	12	12	6.67	8'-0	185.3
24	10	12	12	6.67	8'-0	233.3
26	4	12	14	6.67	5'-0	97.3
26	6	12	12	6.67	5'-0	149.3
26	8	12	12	6.67	5'-0	201.3
26	10	12	12	6.67	5'-0	253.3
28	4	12	15	6.67	5'-0	105.3
28	6	12	13	6.67	5'-0	161.3
28	8	12	12	6.67	5'-0	217.3
28	10	12	12	6.67	5'-0	273.3
30	4	13	17	6.67	4'-0	113.3
30	6	13	15	6.67	4'-0	173.3
30	8	13	14	6.67	4'-0	233.3
30	10	12	14	6.67	4'-0	293.3
32	4	13	19	6.67	4'-0	122.3
32	6	13	17	6.67	4'-0	185.3
32	8	13	14	6.67	4'-0	249.3
32	10	12	14	6.67	4'-0	313.3
34	4	13	20	14	4'-0	122.0
34	6	13	18	14	4'-0	190.0
34	8	13	15	14	4'-0	258.0
34	10	13	15	14	4'-0	326.0
36	6	14	19	14	4'-0	202.0
36	8	14	16	14	4'-0	274.0
36	10	13	16	14	4'-0	346.0
36	12	13	16	14	4'-0	418.0
38	8	14	18	14	3'-0	290.0
38	10	14	18	14	3'-0	366.0
40	8	15	20	14	3'-0	306.0
40	10	15	20	14	3'-0	386.0

① SPAN AND RISE COMINATIONS SHOWN ARE NOMINAL. HY-SPAN STRUCTURES CAN BE FURNISHED IN VIRTUALLY ANY COMBINATION OF SPAN AND RISE. EITHER THE SPAN AND/OR RISE MAY BE FRACTIONAL TO MEET SPECIFIC SITE REQUIREMENTS.

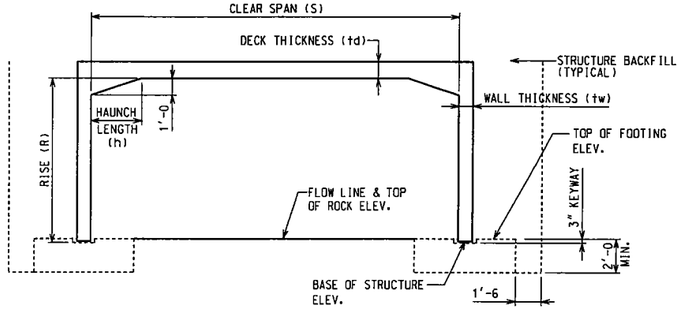
② MAXIMUM COVER HEIGHTS ARE FOR THE MINIMUM MEMBER SIZES REQUIRED FOR EACH SPAN RANGE. STRUCTURES EXCEEDING THIS FILL CAN BE FURNISHED BY INCREASING MEMBER SIZES AS DETERMINED DURING THE DESIGN PROCESS.

③ WATERWAY AREA SHOWN IS FROM LOW STRUCTURE ELEVATION TO BASE OF WALL WITH HAUNCH AREAS DEDUCTED.



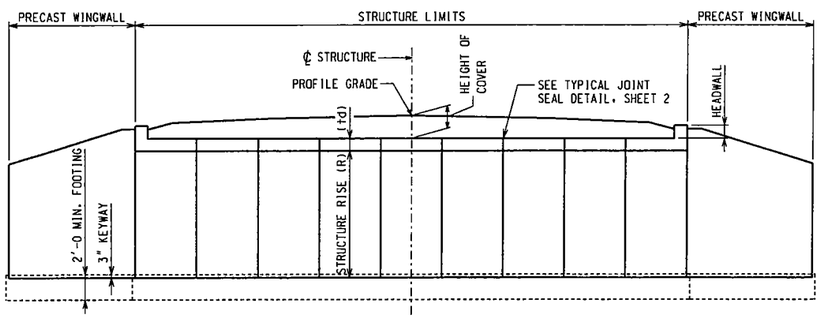
TYPICAL ELEVATION

SCALE: 3/16" = 1'-0



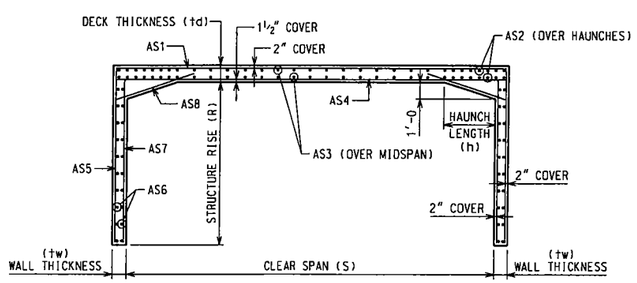
SECTION B-B

SCALE: 1/4" = 1'-0



SECTION A-A

SCALE: 1/4" = 1'-0



TYPICAL STRUCTURE REINFORCING

SCALE: 1/4" = 1'-0

NOTE: REINFORCING SIZE AND SPACING DETERMINED DURING PREPARATION OF STRUCTURAL DESIGN AND SHOP DRAWINGS.

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Date	Revisions	Sym.

Designed: SJC
Drawn: AJE/NAM
Checked: SJC
Scale: As Noted
Date: 7/13/06

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BRIDGE DETAILS

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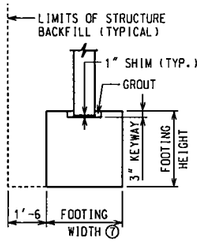
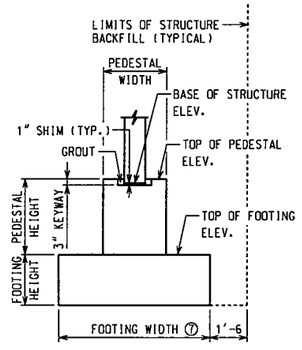
Sheet No: 2 of 5



TYPICAL CULVERT FOOTING

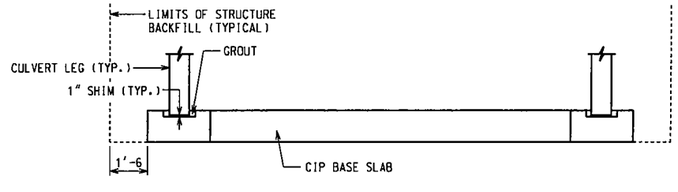
SCALE: $\frac{3}{8}$"=1'-0

⑦ FOOTING WIDTH DETERMINED FOR EACH STRUCTURE BASED ON APPLIED LOADS AND GEOTECHNICAL PARAMETERS.



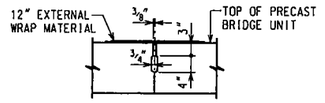
TYPICAL CULVERT FOOTING WITH PEDESTALS

SCALE: $\frac{3}{8}$"=1'-0



TYPICAL BASE SLAB DETAIL

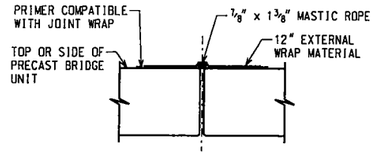
SCALE: $\frac{3}{8}$"=1'-0



TYPICAL KEYWAY DETAIL

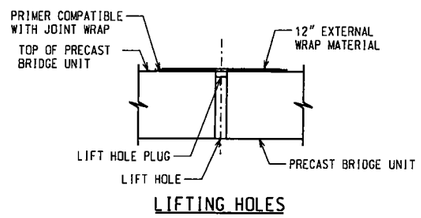
(DECKS WITH LESS THAN 3' OF COVER)
SCALE: $\frac{3}{4}$"=1'-0

NOTE: AFTER ERECTION THE JOINT SHALL BE FILLED WITH NON-SHRINK GROUT.

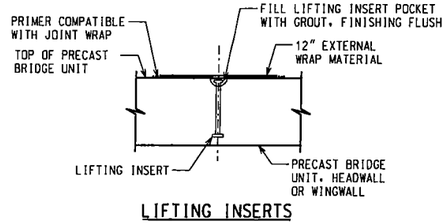


TYPICAL JOINT SEAL DETAIL

(WALLS & DECKS WITH 3'-0 OR GREATER COVER)
SCALE: 1" = 1'-0



LIFTING HOLES



LIFTING INSERTS

TYPICAL LIFTING INSERTS

SCALE: 1" = 1'-0

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HY-SPAN BRIDGE SYSTEM

FOOTING AND JOINT DETAILS

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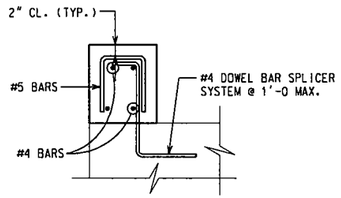
Drawn: AJE/NAM			
Checked: SJC			
Scale: As Noted			
Date: 7/13/06			

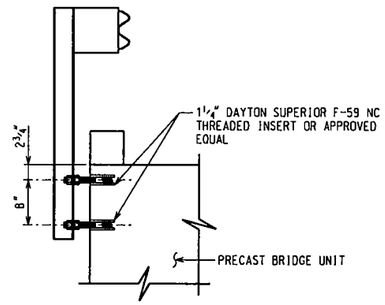
Project No:

Sheet No: 3 of 5



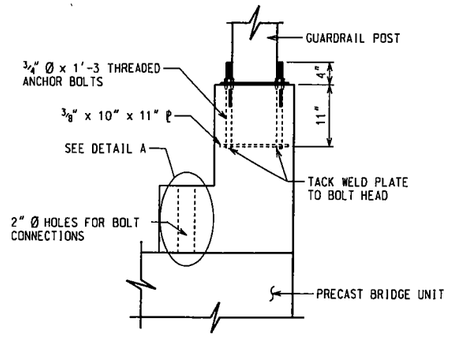
TYPICAL PRECAST HEADWALL

(CAST ON AT PLANT)
SCALE: 1" = 1'-0



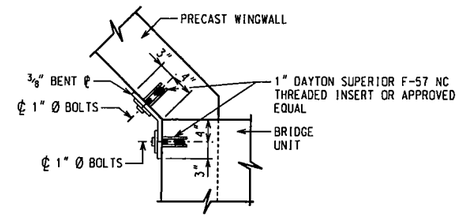
SIDE MOUNTED GUARDRAIL

SCALE: 1"=1'-0



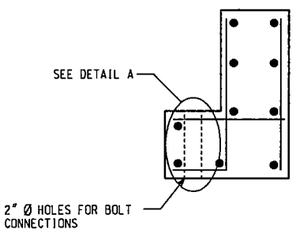
TOP MOUNTED GUARDRAIL

SCALE: 1"=1'-0



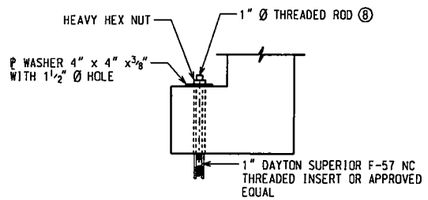
TYPICAL WINGWALL CONNECTION DETAIL

SCALE: 1"=1'-0



TYPICAL PRECAST HEADWALL

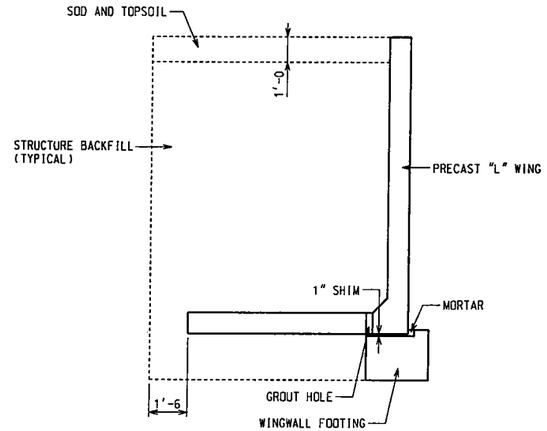
(FIELD BOLTED AT SITE: HEIGHT GREATER THAN 2')
SCALE: 1"=1'-0



DETAIL "A"

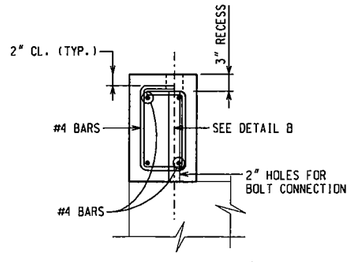
SCALE: 1"=1'-0

⑧ REQUIRED SPACING OF INSERTS AND THREADED RODS TO BE DETERMINED AS PER STRUCTURAL DESIGN AND SHOP DRAWING PREPARATION.



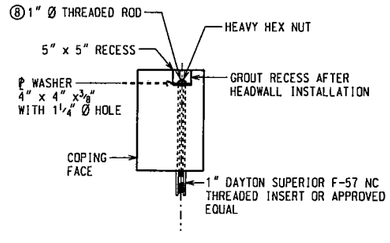
TYPICAL PRECAST WINGWALL

SCALE: ⅜"=1'-0



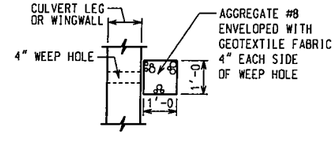
TYPICAL PRECAST HEADWALL

(FIELD BOLTED ON SITE: HEIGHT LESS THAN 2')
SCALE: 1"=1'-0



DETAIL "B"

SCALE: 1"=1'-0



TYPICAL SECTION AT WEEP HOLE

SCALE: ½" = 1'-0

HY-SPAN BRIDGE SYSTEM

HEADWALL AND WINGWALL DETAILS

Revisions	Date	Sym.

Designed: SJC
Drawn: AJE/NAM
Checked: SJC
Scale: As Noted
Date: 7/13/06

HY-SPAN SYSTEMS, INC./ A SUBSIDIARY OF INDEPENDENT CONCRETE PIPE CO.

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(314)842-2900
(419)841-3361

Project No:

Sheet No:
4 of 5

GENERAL NOTES AND SPECIFICATIONS FOR HY-SPAN BRIDGE SYSTEMS

DESCRIPTION

(1) This work shall consist of constructing a precast reinforced concrete three-sided flat-topped structure with headwalls and wingwalls in accordance with the design plans, these standard details, and the following specifications.

MATERIALS

(2) All precast concrete work will be performed by Independent Concrete Pipe Corporation /Hy-Span Bridge Systems, a KYTC approved supplier of precast concrete components. All components will be in strict compliance with section 605 of the KYTC Standard Specifications for Road and Bridge Construction.

(3) All materials shall be in conformance with KYTC Standard Specifications for Road and Bridge Construction, the KYTC List of Approved Materials, section 106.04 of the KYTC Standard Specifications regarding the Buy American Requirement, and all applicable ASTM and AASHTO standards.

(4) Reinforcing steel in structure sections shall be welded wire fabric, welded deformed steel wire fabric, or deformed billet steel bars in accordance with KYTC Standard Specifications, Section 811. Reinforcing steel in the wingwalls, pedestals, base slabs, headwalls, and footings shall be deformed billet steel bars in accordance with KYTC Standard Specifications, Section 811. Reinforcing steel in headwalls and structure sections with less than two feet of cover shall be epoxy coated.

(5) Concrete shall be in accordance with Section 601 of the KYTC Standard Specifications utilizing the following design strengths. The minimum 28 day concrete design strength shall be f'c = 5,000 psi for structure sections, f'c = 4,000 for headwalls and wingwalls and f'c = 3,500 psi for footings. Structure sections for spans greater than 30' shall utilize f'c from 5,000 psi up to a maximum of 6,000 psi as determined during design of the structure.

(6) Steel used in bolted connections of wingwalls to structure sections shall be in accordance with ASTM A 709 grade 36 (ASTM A 709M grade 250) and galvanized after fabrication in accordance with ASTM A 153 (ASTM A 153M). Class A or B. Bolts shall be in accordance with ASTM A 307 and galvanized in accordance with ASTM A 153 (ASTM A 153M)

DESIGN

(7) Hy-Span Systems on behalf of the Contractor shall submit, for approval, three copies of design computations and shop drawings. The index sheet of the design calculations and each sheet of the shop drawings shall be signed by and bearing the seal of a Kentucky licensed professional engineer. The shop drawings shall include all details, dimensions, and quantities necessary to construct the structure, wingwalls, and headwalls if applicable and shall include, but not be limited to, the following information.

- (a) Structure span and rise;
- (b) Structure section details showing all concrete dimensions and reinforcing steel requirements;
- (c) Design computations and details for pedestals, when required;
- (d) Footing details showing all concrete dimensions, elevations, and reinforcing steel with bar size, bar bending diagrams, length, and spacing indicated. Footing plan and section views shall be provided. The actual soil bearing pressure shall be noted on the footing detail sheets.
- (e) Wingwall design computations and details showing all concrete dimensions, reinforcing steel, bar bending diagrams, and anchorage details. Wingwall plan, elevation, and section views shall be provided.
- (f) Headwall details, showing all concrete dimensions, reinforcing steel, bar bending diagrams, and anchorage details. Headwall elevation and section views shall be provided.
- (g) Structure backfill type and limits for the structure and wingwalls.

(8) Structure section or wingwall fabrication shall not begin until written approval of the shop drawings and design computations have been received from the Engineer.

(9) The structure sections shall be designed for:

- (a) The weight of the structure.
- (b) Superimposed dead load including the weight of pavement and backfill.
- (c) An allowance for a future wearing surface as shown on the Design Plans or 60 psf if no criteria is shown.
- (d) Horizontal earth pressures applied to the sides of the structure based on a minimum equivalent fluid pressure of 40 lb/ft3 (6.3 kN/m3).
- (e) The live load plus impact shown on the Design Plans for the structure, or HL-93 in accordance with the AASHTO LRFD Bridge Design Specifications, if no live load design criteria is shown on the Design Plans.

(10) Wingwalls and headwalls shall be designed based on a minimum equivalent fluid pressure of 40 lb/ft3 (6.3 kN/m3). Horizontal pressures shall be increased for sloping backfill surfaces and live load surcharge. Footings shall be designed for the allowable soil bearing shown on the plans. Wingwalls and wingwall footings shall be designed in accordance with the soil parameters shown on the plans. Wingwall footings and headwall connections shall be checked for sliding and for overturning utilizing a factor of safety of 1.5 in accordance with KYTC Guidance Manual SD-405. Headwalls with bridge rail mounted on top and the anchorage of the headwall to the structure section shall be designed for AASHTO traffic railing loadings. Continuity shall be established between the structure footing and the wingwall footing.

(11) The cover dimension over the top mat of reinforcement shall be a minimum of 2 in. (50 mm). The cover over the lower mat of reinforcement in the structure top shall be a minimum of 1.5 in. (40 mm). The clear distance of the end circumferential reinforcement shall not be less than 1 in. (25 mm) nor more than 2 in. (50 mm) from the ends of the structure section. The ends of the longitudinal distribution reinforcement shall not be more than 2 in. (50 mm) from the ends of the structure section.

(12) Cover for wingwall, pedestal, and headwall reinforcement shall be a minimum of 2 in. (50 mm). Cover for footing and base slab reinforcement shall be 3 in. (75 mm) for the top and sides and 4 in.(100 mm) for the bottom.

(13) Except as noted herein, reinforcing steel splicing and spacing requirements shall be in accordance with the AASHTO document shown on the General Plan for the structure or the AASHTO LRFD Bridge Design Specifications if no AASHTO document is shown. Tension splices in circumferential reinforcement shall be made by lapping. Deformed billet steel bars used for longitudinal distribution reinforcement shall have a center to center spacing not to exceed 12 in. The maximum spacing for wingwall reinforcing steel shall be 18 in. (450 mm) for horizontal bars and 12 in. (300 mm) for vertical bars. Exterior corner reinforcement in the bridge units shall be fully developed beyond the point where it is no longer required to resist flexure.

(14) Weep holes shall be included in the structure and wingwalls in accordance with KYTC Standard Specification 610.03.03.

(15) Wingwall sections are designed as self supporting sections. Connections to the structure or adjacent wingwall sections do not carry any calculated forces and are for continuity only.

MANUFACTURE

(16) Handling devices or holes will be permitted in each structure or wingwall section. However, not more than six holes shall be cast or drilled in each section. Cast holes shall be tapered.

(17) The section ends shall be of such design and shall be so formed that when the structure sections are erected, they shall make a continuous line of structure with a smooth interior free of irregularities.

(18) The structure sections and wingwalls shall be free of fractures. Exposed edges of precast elements shall be beveled $\frac{3}{4}$". The ends of the structure sections shall be normal to the walls and centerline, except where beveled ends are specified. The surface of the structure section shall be a smooth steel form or troweled surface. Trapped air pockets causing surface defects shall be considered as part of a smooth steel form finish.

(19) Wingwalls shall be given a finish in accordance with KYTC Standard Specification 601.03.18(A).

(20) The structure units shall not be stored in an upright position until the designated handling and storage compressive strength, as shown on the shop drawings, has been achieved.

(21) Each structure section and wingwall shall be clearly marked with waterproof paint. The following information shall be shown on the inside face of each wingwall and on a vertical leg of each structure section.

- (a) structure span and rise (structure sections only)
- (b) date of manufacture
- (c) name or trademark of the manufacturer
- (d) design earth cover

TESTING AND INSPECTION

(22) Concrete compressive strength shall be determined from compression tests made on cylinders or cores. For cylinder testing, a minimum of four cylinders shall be taken during each production run. For core testing, one core shall be cut from three structure sections selected at random from each group of 15 structure sections or less of a particular size and production run. One core shall be cut from each group of four or fewer wingwalls. For each continuous production run, each group of 15 structure sections of a single size or fraction thereof or four wingwalls shall be considered separately for the purpose of testing and acceptance. A production run shall be considered continuous if not interrupted for more than three consecutive days.

(23) Cylinders shall be made and tested in accordance with ASTM C 39. Cores shall be obtained and tested for compressive strength in accordance with ASTM C 497 (ASTM C 497M).

(24) The compressive strength of the concrete cylinders tested in each group of sections as defined above will be acceptable when the average core test strength is equal to or greater than the design concrete strength, not more than 10% of the cylinders tested have a compressive strength less than the design concrete strength, and no cylinder tested has a compressive strength less than 80% of the design concrete strength.

(25) If the compressive strength of the cylinders tested does not meet the above requirements, the acceptability of the production run may be determined by testing cores from the structure section or wingwall. The production group is acceptable if the average core concrete strength is greater than the design concrete strength. When the compressive strength of the core tested is less than the design concrete strength, the precast element from which that core was taken may be recored. If the compressive strength of the recore is equal to or greater than the design concrete strength, the compressive strength of the concrete in that group of sections will be acceptable.

(26) The core holes shall be plugged and cured by the manufacturer in such a manner that the structure will meet all the test requirements of these specifications. Structure sections or wingwalls repaired accordingly will be considered satisfactory for use.

(27) The manufacturer shall furnish all facilities, equipment, and personnel necessary to conduct the required testing.

(28) Structure sections or wingwalls shall be considered acceptable based on meeting the above test results subject to the following exceptions.

- (a) fractures or cracks passing through the wall, except for a single end crack which does not exceed one half the thickness of the wall;
- (b) defects which indicate proportioning, mixing, or molding which are not in accordance with this specification;
- (c) honeycombed or open texture; or
- (d) damaged section ends, where such damage prevents making a satisfactory joint

(29) Structure sections or wingwalls may be repaired, if necessary, due to imperfections in manufacture, handling damage, or construction. Repairs will be acceptable if it is determined that the repairs are sound, properly finished and cured, and if the repaired structure section or wingwall is in accordance with the requirements herein.

INSTALLATION

(30) The soils in the bottom of the excavation shall be compacted to 95% of the maximum dry density. If 95% of the maximum dry density cannot be obtained in the bottom of the excavation or in other areas, the KYTC and/or their geotechnical representative shall be contacted for additional recommendations. If during construction, soft soils are encountered at depths that make removal impractical, KYTC and/or their geotechnical representative shall be contacted for additional recommendations.

(31) Footings may be cast-in-place or precast. When a precast footing is utilized, a 4 in. (100 mm) layer of uniformly compact sand shall be placed under the full width of the footing. All footings shall be given a floated surface finish in accordance with KYTC Standard Specification 601.03.18(C). The footing concrete shall reach a compressive strength of 2,500 psi (17 500 kPa) before placement of the structure sections or wingwalls. The surface shall not vary more than $\frac{1}{4}$ in. in 10 ft (6 mm in 3 m) when tested with 10 ft (3 m) straightedge.

(32) When a reinforced concrete pedestal is required between the base of the structure leg and the top of the footing, the Contractor shall have the option of providing a structure with extended legs or constructing the pedestals.

(33) The structure sections and wingwalls shall be set on masonite. A minimum gap of 0.5 in. (13 mm) shall be provided between the footing and the bottom of each section or wingwall. The gap shall be filled with a mortar in accordance with KYTC Standard Specifications Section 601. Structure legs shall be grouted or adequately restrained prior to applying any loads to the top of the culvert.

(34) The structure sections with less than 3 ft (0.9 m) of cover shall be produced with a minium 4 in. (100 mm) deep by 1.5 in. (40 mm) wide keyway joint. Structures with 3 ft (0.9 m) or more of cover may be produced with either the above keyway or butt joints. Mortar in accordance with KYTC Standard Specifications Section 601 shall be placed in the keyway joint.

(35) All butt joints between structure sections shall be covered with a external joint wrap in accordance with ASTM C 877 (ASTM C 877M), type II. The surface shall be free of dirt before the joint material is applied. The entire joint shall be continuously covered. Joints between structure sections and wingwalls and between structure sections and headwalls shall be covered with either the same wrap used between structure sections or with geotextile in accordance with KYTC Standard Specifications Section 214.

(36) The external joint wrap shall be kept in its proper location over the joint and care shall be taken to prevent damage during the backfilling operation.

(37) Tapered or drilled holes for handling shall be filled in accordance with the applicable provisions of KYTC Standard Specifications Section 601. Prior to backfilling the structure, all holes shall be covered with joint wrap material with a minimum width of 9 in. (225 mm).

(38) Structure backfill shall be placed and compacted in accordance with KYTC Standard Drawing RDI-120-03.

(39) When the level of structure backfill reaches the top of the structure, two lifts shall be spread and hand compacted over the structure without traversing the structure with heavy equipment. Compaction with heavy equipment will not be allowed until a minimum of two lifts have been placed, hand compacted, and tested.

(40) Structure backfill shall be placed and compacted to the same elevation on both sides of the structure before proceeding to the next layer.

(41) When the height of cover as shown on the plans is 12 in. (300 mm) or less, the structure under the paved portion of the roadway and shoulders shall be backfilled with flowable fill to the top of the vertical leg of the structure.

(42) The operation of equipment over the structure shall be in accordance with the structure manufacturer's recommendations.

HY-SPAN The Instant Bridge

	Sym.	Revisions	Date

Designed: SJC
Drawn: AJE/MAM
Checked: SJC
Scale: As Noted
Date: 7/13/06

HY-SPAN BRIDGE SYSTEM

GENERAL NOTES AND SPECIFICATIONS

HY-SPAN SYSTEMS, INC./ A SUBSIDIARY OF INDEPENDENT CONCRETE PIPE CO.

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LOUISVILLE, KY	(502)448-2920
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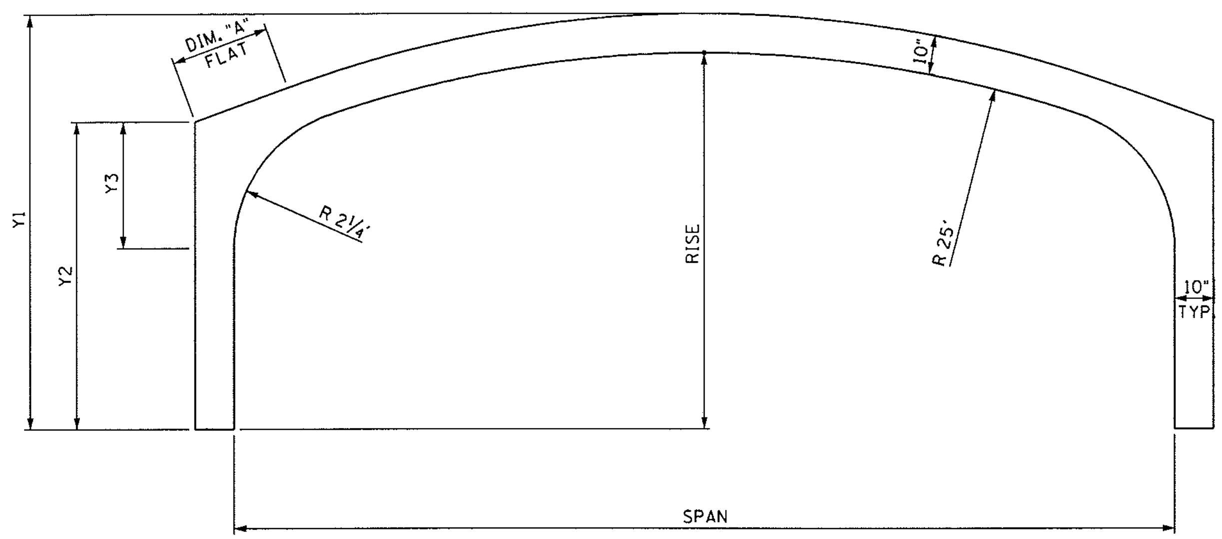
MISHAWAKA, IN	(219)259-5401
ST. LOUIS, MO	(314)842-2900
TOLEDO OH	(419)841-3361

Project No:

Sheet No: 5 of 5



AQUA-ARCH TYPICAL SECTION
SHOWING DIMENSIONS N.T.S

RISE (FT)	SPAN=16 FT. Y1	Y2	Y3	A	WATERWAY (SF)
5	5'-10"	4'-3 5/16"	2'-9 5/8"	0'-0"	71.04
6	6'-10"	5'-3 5/16"	2'-9 5/8"	0'-0"	87.04
7	7'-10"	6'-3 5/16"	2'-9 5/8"	0'-0"	103.04
8	8'-10"	7'-3 5/16"	2'-9 5/8"	0'-0"	119.04
9	9'-10"	8'-3 5/16"	2'-9 5/8"	0'-0"	135.04
10	10'-10"	9'-3 5/16"	2'-9 5/8"	0'-0"	151.04

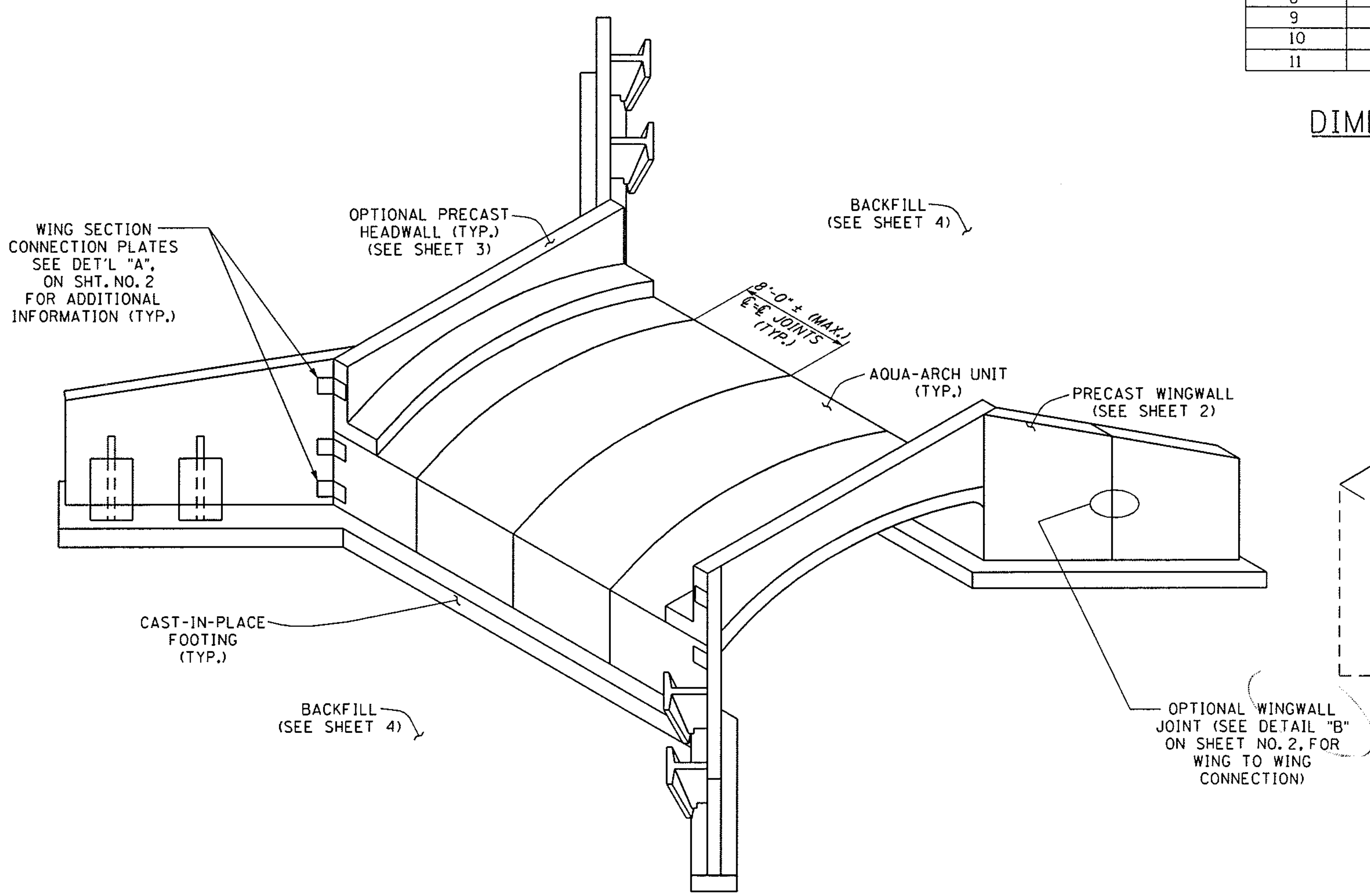
RISE (FT)	SPAN=20 FT. Y1	Y2	Y3	A	WATERWAY (SF)
5	5'-10"	3'-6 9/16"	2'-8 1/8"	2'-1 1/2"	84.74
6	6'-10"	4'-6 9/16"	2'-8 1/8"	2'-1 1/2"	104.74
7	7'-10"	5'-6 9/16"	2'-8 1/8"	2'-1 1/2"	124.74
8	8'-10"	6'-6 9/16"	2'-8 1/8"	2'-1 1/2"	144.74
9	9'-10"	7'-6 9/16"	2'-8 1/8"	2'-1 1/2"	164.74
10	10'-10"	8'-6 9/16"	2'-8 1/8"	2'-1 1/2"	184.74
11	11'-10"	9'-6 9/16"	2'-8 1/8"	2'-1 1/2"	204.74

RISE (FT)	SPAN=24 FT. Y1	Y2	Y3	A	WATERWAY (SF)
5	5'-10"	2'-9 13/16"	2'-8 15/16"	4'-3 1/16"	94.88
6	6'-10"	3'-9 13/16"	2'-8 15/16"	4'-3 1/16"	118.88
7	7'-10"	4'-9 13/16"	2'-8 15/16"	4'-3 1/16"	142.88
8	8'-10"	5'-9 13/16"	2'-8 15/16"	4'-3 1/16"	166.88
9	9'-10"	6'-9 13/16"	2'-8 15/16"	4'-3 1/16"	190.88
10	10'-10"	7'-9 13/16"	2'-8 15/16"	4'-3 1/16"	214.88
11	11'-10"	8'-9 13/16"	2'-8 15/16"	4'-3 1/16"	238.88

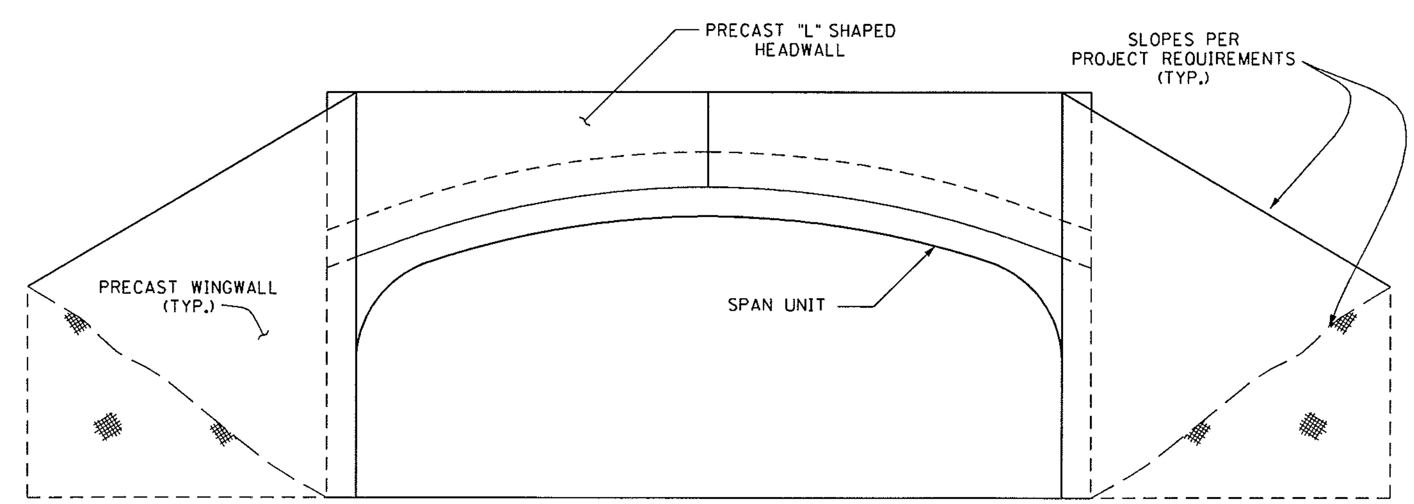
DIMENSIONS AND WATERWAY AREAS

GENERAL NOTES

1. DESIGN SPECIFICATION: AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS , 2004 EDITION W/CURRENT INTERIMS THRU 2006.
2. DESIGN LIVE LOAD: HL-93.
3. INSTALLATION TO BE IN ACCORDANCE WITH PRODUCT INSTALLATION GUIDELINES. SEE SHEET NO. 4 FOR ADDITIONAL REQUIREMENTS.
4. SEE SHEET 4 FOR MATERIALS SPECIFICATIONS.
5. STRUCTURAL DESIGN BY A PROFESSIONAL ENGINEER LICENSED IN THE STATE OF KENTUCKY TO BE PROVIDED BY SHERMAN DIXIE CONCRETE INDUSTRIES UPON SUBMITTAL OF SHOP DRAWINGS FOR EACH SITE.



AQUA-ARCH ISOMETRIC
SHOWING COMPONENTS N.T.S



END ELEVATION

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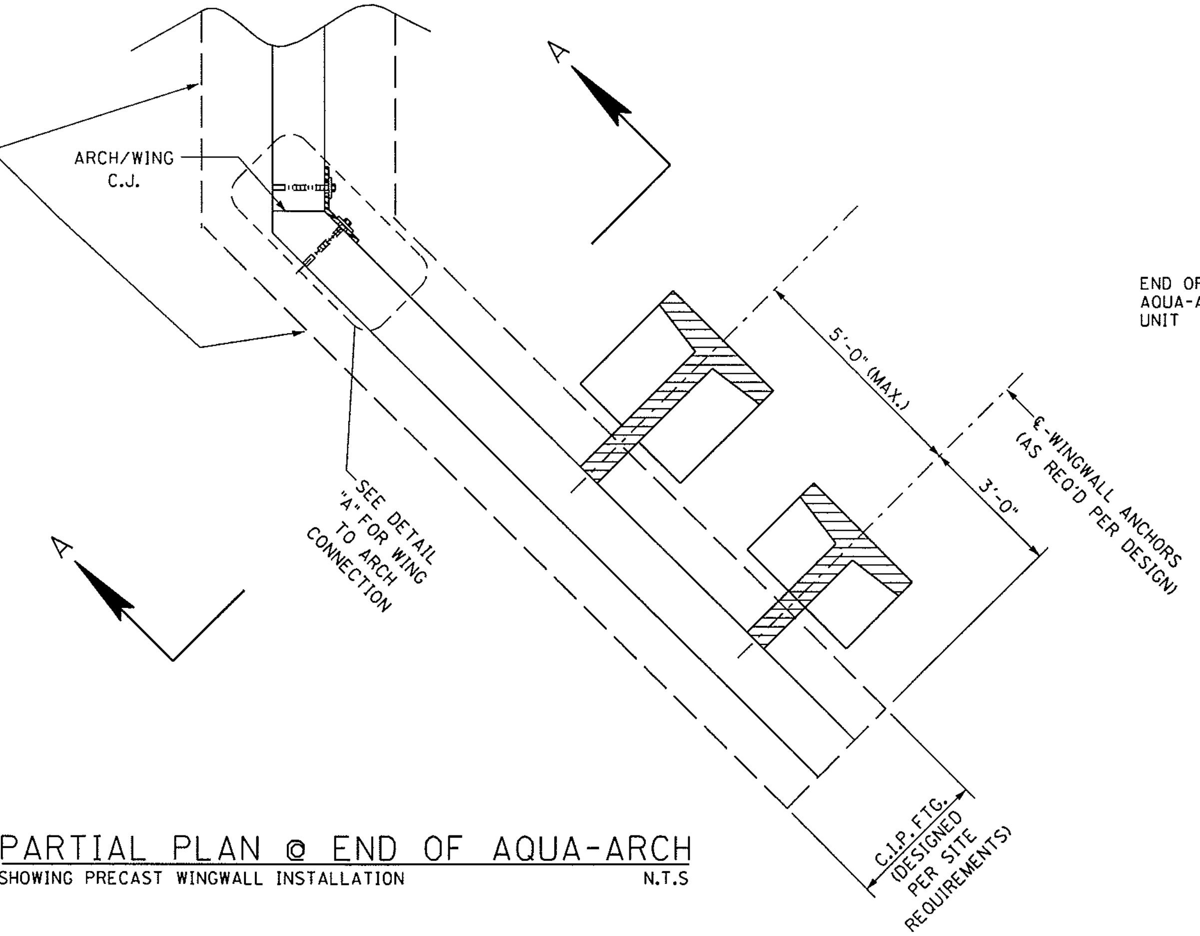
SHERMAN DIXIE
PH# 1-800-737-0707

GENERAL LAYOUT AND DETAILS
AQUA-ARCH DESIGN SCHEMATICS
KENTUCKY TRANSPORTATION CABINET

ISSUE / REVISIONS

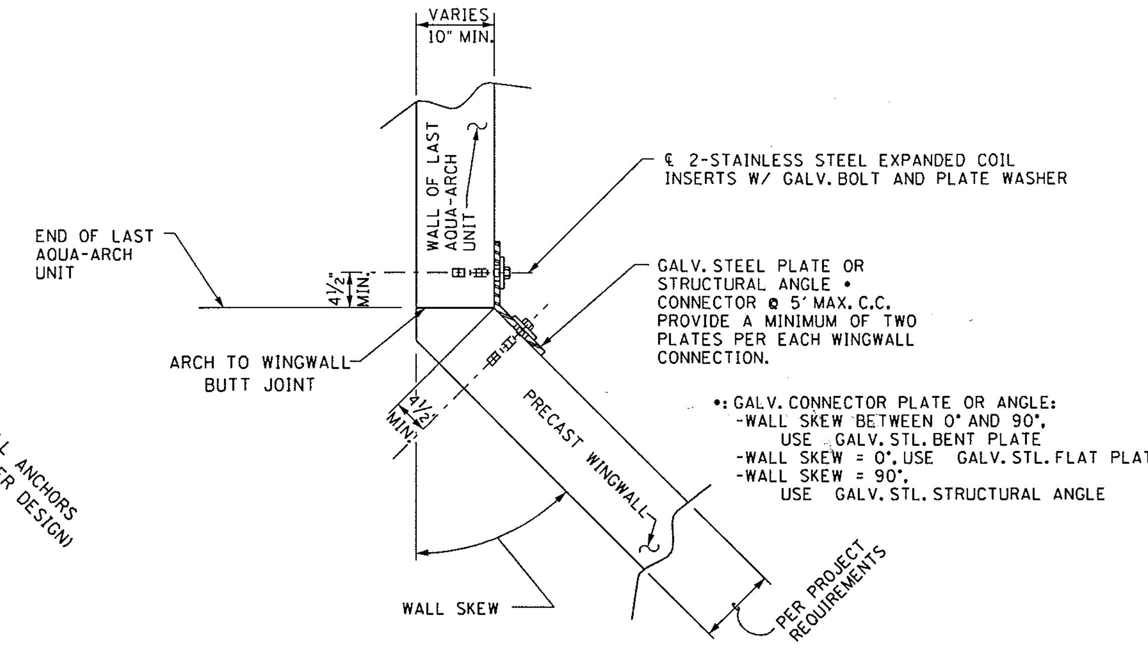
NO.	DESCRIPTION	DATE	BY
1	ORIGINAL ISSUE	02/26/07	WAP
2	WING JT. REF'NCE.	11/30/07	WAP

SHEET 1 OF 4



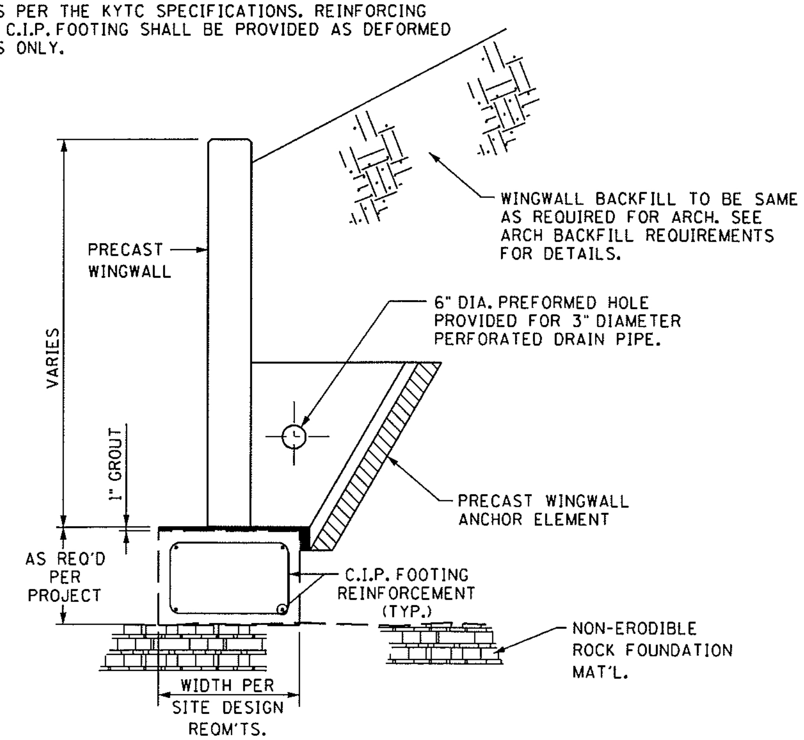
NOTE: WINGS MAY BE POURED IN PLACE IN ACCORDANCE WITH KYTC STANDARDS IN LIEU OF INSTALLING PRECAST WINGWALLS.

PARTIAL PLAN @ END OF AQUA-ARCH
SHOWING PRECAST WINGWALL INSTALLATION N.T.S

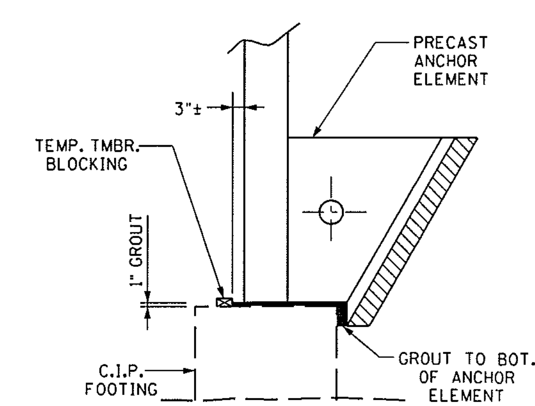


DETAIL "A": WING TO AQUA-ARCH ATTACHMENT

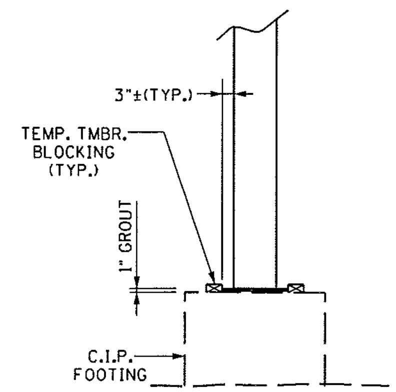
NOTE: REINFORCING STEEL AREAS FOR C.I.P. FOOTING AND PRECAST WINGWALL TO BE DETERMINED PER PROJECT REQUIREMENTS. STEEL AREAS FOR WALL MAY BE SUPPLIED AS EITHER W.W.F. OR DEFORMED STEEL BARS PER THE KYTC SPECIFICATIONS. REINFORCING STEEL FOR C.I.P. FOOTING SHALL BE PROVIDED AS DEFORMED STEEL BARS ONLY.



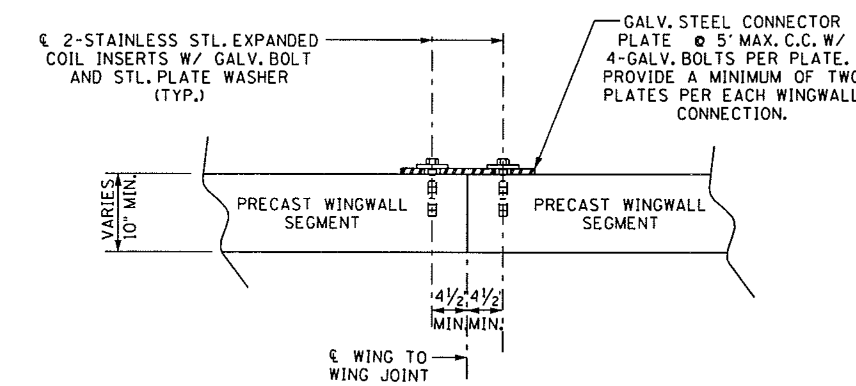
SECTION A-A



GROUT DETAIL
@ WING ANCHOR



GROUT DETAIL
@ WING



DETAIL "B"
WING TO WING ATTACHMENT

SHERMAN DIXIE
PH# 1-800-737-0707

WINGWALL DETAILS

AQUA-ARCH DESIGN SCHEMATICS
KENTUCKY TRANSPORTATION CABINET

ISSUE / REVISIONS

NO.	DESCRIPTION	DATE	BY
1	ORIGINAL ISSUE	02/26/07	WAP
2	GRT. ℄ WING DTLS.	11/30/07	WAP

SHEET 2 OF 4

11/30/2007 08:47:51 AM
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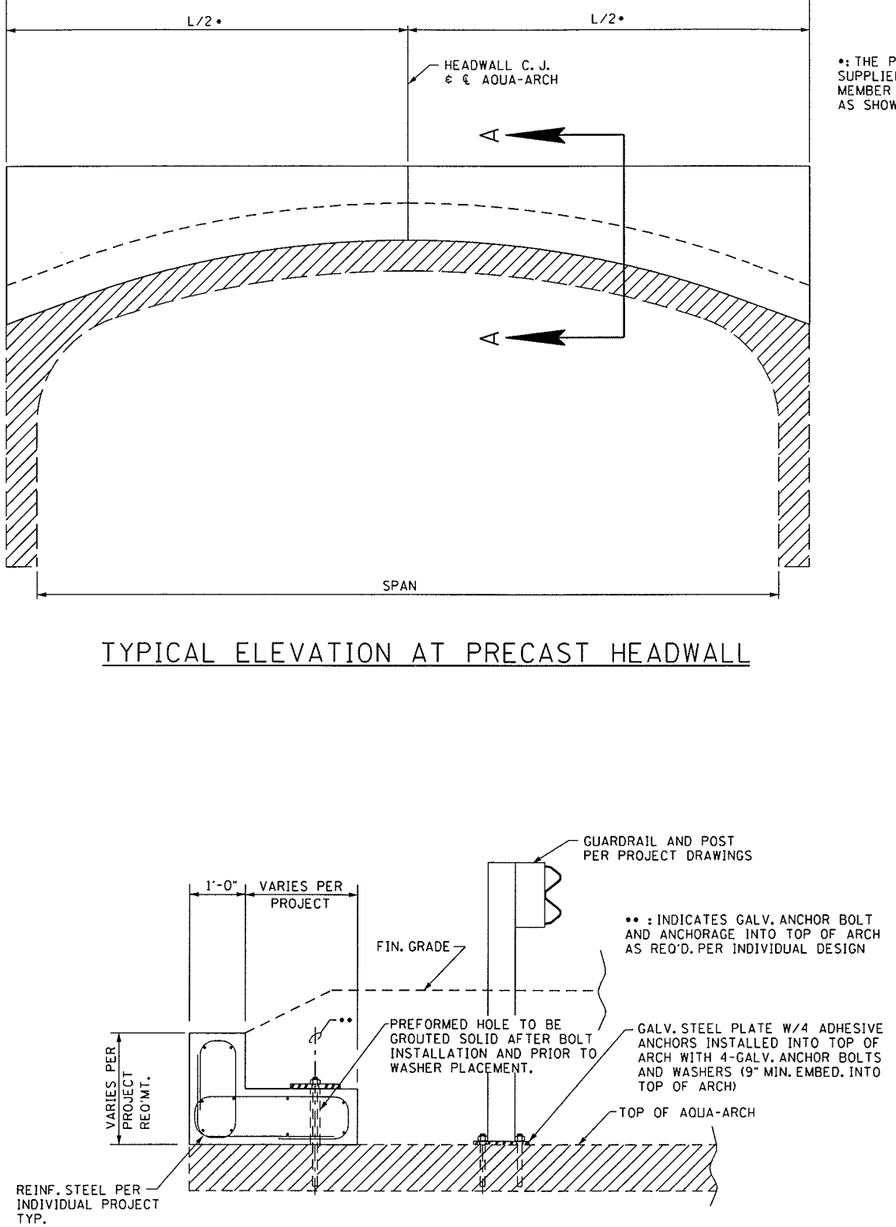
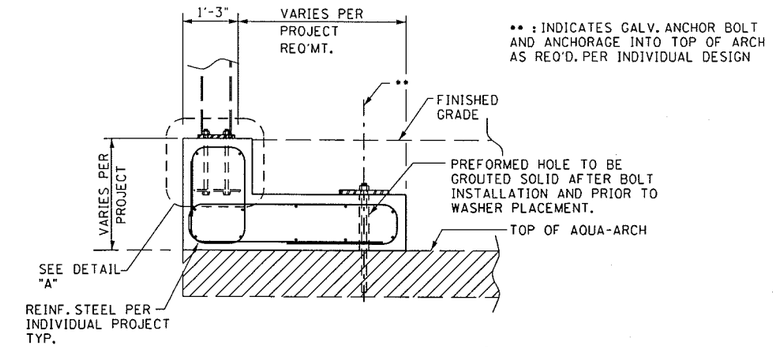
•: THE PRECAST HEADWALL MAY BE SUPPLIED IN EITHER ONE CONTINUOUS MEMBER OR IN TWO EQUAL PIECES AS SHOWN

TYPICAL ELEVATION AT PRECAST HEADWALL

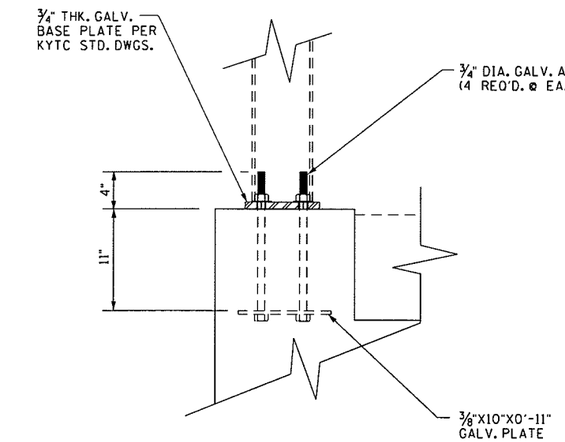


SECTION A-A SHOWING GUARDRAIL ATTACHED TO TOP OF ARCH



SECTION A-A SHOWING GUARDRAIL ATTACHED TO TOP/HEADWALL

SPECIAL NOTE: AT THE MANUFACTURER'S DESCRETION, THE PRECAST HEADWALL MAY BE CAST ONTO THE EXTERIOR SEGMENTS OF THE AQUA ARCH UNITS AND SHIPPED AS AN INTEGRAL COMPONENT OF THE END SEGMENTS.



DETAIL "A"

SILERMAN DIXIE
PH# 1-800-737-0707

HEADWALL & GUARDRAIL ATTACHMENT DETAILS

AQUA-ARCH DESIGN SCHEMATICS
KENTUCKY TRANSPORTATION CABINET

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1	ORIGINAL ISSUE	02/26/07	WAP

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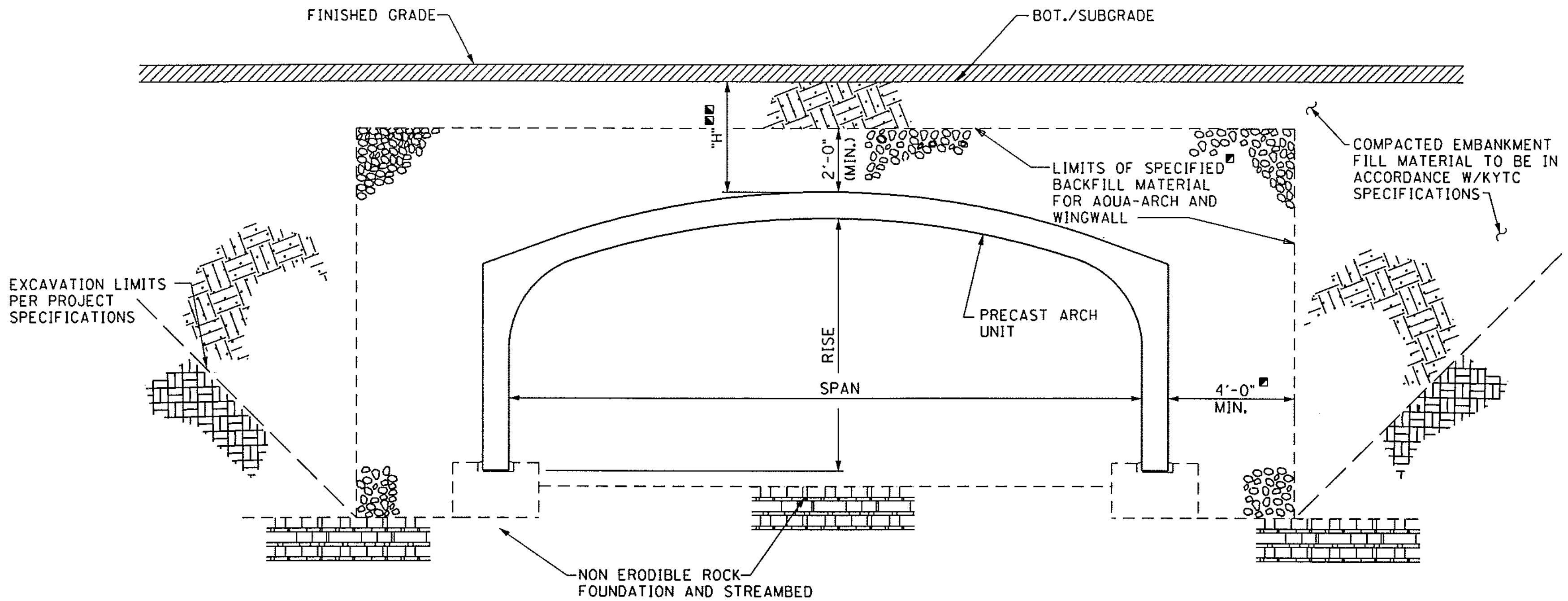


■■: FOR FILL HEIGHT, H<2.0', PLACE SPECIFIED ARCH BACKFILL MATERIAL TO BOTTOM OF ROADWAY SUBGRADE.

MAXIMUM FILL, "H"=30'-0".

■: BACKFILL MATERIAL TO BE IN ACCORDANCE WITH THE FOLLOWING REQUIREMENTS AS DESIGNATED IN CHAPTER M-145-91 OF THE AASHTO STANDARD SPECIFICATIONS FOR TRANSPORTATION MATERIALS AND METHODS OF SAMPLING AND TESTING:
FOR H<12'-0" SOIL GROUPS A1,A2,A3 OR A4
FOR H>12'-0" SOIL GROUPS A1 OR A3

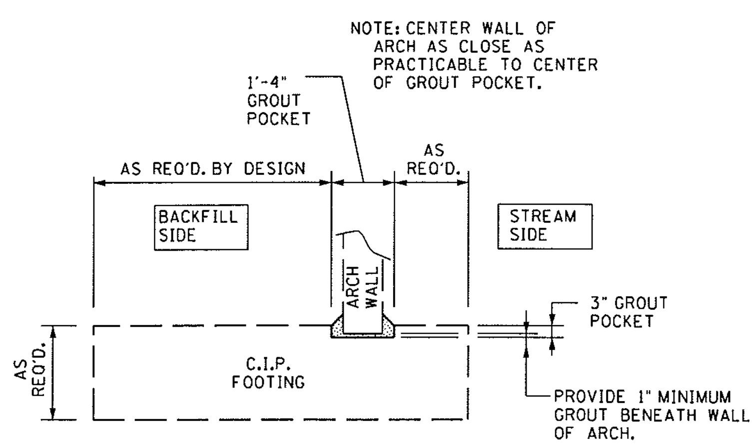
TYPICAL SECTION SHOWING BACKFILL REQUIREMENTS

GENERAL MATERIALS REQUIREMENTS

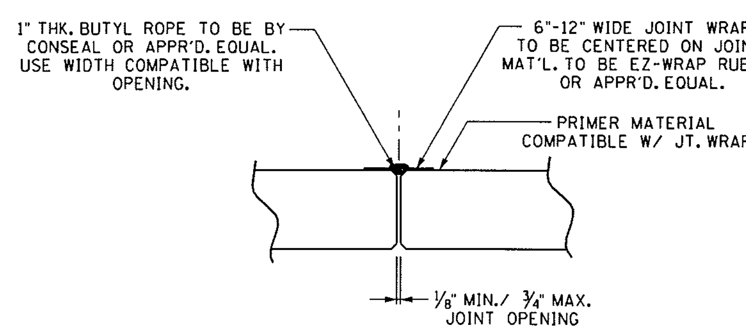
1. MATERIALS SPECIFICATIONS: ALL CONSTRUCTING MATERIALS SHALL BE IN ACCORDANCE WITH THE KTYC STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION,THE KYTC LIST OF APPROVED MATERIALS, AND ALL APPLICABLE ASTM AND AASHTO STANDARDS.
2. PRECAST CONCRETE COMPONENTS SHALL BE MANUFACTURED BY SHERMAN DIXIE CONCRETE INDUSTRIES, A KYTC APPROVED FABRICATOR, IN ACCORDANCE WITH THE PLANS AND IN STRICT COMPLIANCE WITH SECTION 605 OF THE KYTC, DEPARTMENT OF HIGHWAYS, STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION.
3. ALL MATERIALS SHALL BE PROVIDED IN ACCORDANCE WITH SECTION 106.04 OF THE KYTC STANDARD SPECIFICATIONS BUY AMERICA REQUIREMENT.
4. CONCRETE TO BE IN ACCORDANCE WITH SECTION 601 OF THE KYTC SPECIFICATIONS. REQUIRED MINIMUM 28 DAY CONCRETE STRENGTHS TO BE AS FOLLOWS:
   PRECAST ARCH UNITS: 5000 P.S.I.
   PRECAST HEADWALLS AND WINGWALLS: 4000 P.S.I.
   CAST-IN-PLACE FOOTINGS: 3500 P.S.I.
5. REINFORCING STEEL FOR PRECAST UNITS, HEADWALLS, AND WINGWALLS, SHALL BE EITHER WELDED WIRE FABRIC, DEFORMED WELDED WIRE FABRIC, OR DEFORMED STEEL BARS IN ACCORDANCE WITH THE KYTC SPECIFICATIONS.
6. FOUNDATIONS:
   CAST-IN-PLACE FOOTINGS TO REST UPON NON-ERODIBLE ROCK FOUNDATION MATERIAL UNLESS OTHERWISE APPROVED BY THE KYTC DEPARTMENT OF HIGHWAYS.
7. 4" DIA. WEEP HOLES SHALL BE PROVIDED IN AQUA-ARCH UNITS AND PRECAST WINGWALLS IN ACCORDANCE WITH SECTION 611 OF THE KYTC STANDARD SPECIFICATIONS.

BACKFILL REQUIREMENTS

1. BACKFILL OF ARCH SHALL BE IN STRICT COMPLIANCE WITH THE INSTRUCTIONS HEREIN AND IN ACCORDANCE WITH PROJECT SPECIFICATIONS. THE CONTRACTOR SHALL PROVIDE ADEQUATE TESTING AND MONITORING OF BACKFILL MATERIALS AND PLACEMENT AND COMPACTION PROCEDURES. THE CONTRACTOR SHALL NOT PROCEED WITH BACKFILL OPERATIONS WITHOUT CONTINUOUS MONITORING AND DOCUMENTATION OF THE PROPER PLACEMENT PROCEDURE AND DENSITY OF THE IN PLACE BACKFILL MATERIALS.
2. FOUNDATION MATERIAL: FOOTINGS FOR THE ARCH STRUCTURE AND WINGWALL SHALL BE CAST-IN-PLACE AND SHALL BE DESIGNED ON A PER PROJECT BASIS. FOOTINGS SHALL BE CAST UPON NON-ERODIBLE ROCK FOUNDATION MATERIAL UNLESS OTHERWISE APPROVED BY THE KYTC DEPARTMENT OF HIGHWAYS.
3. WITHIN THE LIMITS DESIGNATED IN THE TYPICAL SECTION FOR BACKFILL, THE BACKFILL MATERIAL SHALL BE IN ACCORDANCE WITH THE SPECIFIED AASHTO GRADATION. OUTSIDE OF THIS ZONE, BACKFILL SHALL BE IN ACCORDANCE WITH KYTC SPECIFICATIONS REGARDING BACKFILL.
4. SPECIFIED BACKFILL MATERIAL FOR ARCH SHALL BE PLACED IN ACCORDANCE WITH THE FOLLOWING:
   A. BACKFILL ADJACENT TO ARCH COMPONENTS SHALL BE PLACED SO AS NOT TO DAMAGE JOINT OR WATERPROOFING MATERIALS FOR THE ARCH.
   B. BACKFILL SHALL BE PLACED AND COMPACTED IN 8" LAYERS TO 95% OF THE MAXIMUM DRY DENSITY FOR THE MATERIAL USED. COMPACTION EQUIPMENT SHALL CONSIST OF MECHANICAL HAND-DRIVEN TAMPERS OR OTHER LIGHT COMPACTION EQUIPMENT UP TO NO LESS THAN H=1' ABOVE THE TOP OF ARCH. BEYOND THE 1' LIMIT, LIGHTWEIGHT VEHICULAR EQUIPMENT MAY BE USED FOR COMPACTION (I.E. EQUIPMENT WEIGHING LESS THAN 12 TONS).
   C. THE BACKFILL LEVELS AT EACH END OF ARCH SHALL BE KEPT AS CLOSE AS PRACTICABLE TO THE SAME ELEVATION AT ALL TIMES DURING THE BACKFILL OPERATIONS. THE MAXIMUM ALLOWABLE DIFFERENCE IN ELEVATIONS BETWEEN BACKFILLS AT EACH END OF ARCH SHALL BE 2'-0" AT ALL TIMES DURING BACKFILL OPERATIONS.



GROUT DETAIL @ BASE OF AQUA ARCH



TYPICAL JOINT SEAL BETWEEN AQUA-ARCH UNITS

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GENERAL LAYOUT AND DETAILS
AQUA-ARCH DESIGN SCHEMATICS
KENTUCKY TRANSPORTATION CABINET

ISSUE / REVISIONS

NO.	DESCRIPTION	DATE	BY
1	ORIGINAL ISSUE	02/26/07	WAP
2	ADD GRT.&JT.DTLS.	11/30/07	WAP

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